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EDITORIAL

THE SECOND ANNUAL meeting of the Soil Conservation Society of America is just ahead of us. Perhaps this is a good time to begin formulate a more specific program for the Society. Society membership is increasing, the JOURNAL is gradually taking more appropriate shape, we have a neatly printed news sheet—NOTES AND ACTIVITIES, and we gather at stimulating annual nationals as well as more frequent local chapter meetings. One of the important issues before us at Omaha should be the program statement to which the Society will more ardently dedicate itself.

Several articles in the JOURNAL have stated objectives of the Society. The first issue of the JOURNAL carried an article, "Why Another Society?" and in his annual address last year, the President of the Society ably stated objectives for us. It is our task now to translate what Mr. Musser has set forth into an active program. We know what we *stand* for, we need now to know what we *work* for. The following elements in a program for the Society are suggestions for immediate consideration and inauguration:

1. Annually award appropriate citations for the outstanding contributions to the science of soil and water conservation.
2. Support or contribute to an annual scholarship, including foreign assignments going to promising young soil conservationists.
3. Present complimentary three-year subscriptions of the JOURNAL to highest ranking students completing college and university courses in soil conservation.
4. Support publication of special and outstanding studies useful to the professional soil conservationist.
5. Arrange for representatives of the Society to sit with various independent organizations whose objectives are to further conservation.
6. Present statements to appropriate governmental organizations, such as FAO, in support of scientific application of soil and water conservation throughout the world.
7. Present before legislative bodies statements and testimony in support of measures that affect the professional soil conservationist.

Other things will occur to us as we crystallize a program to which the Society can be dedicated. It is time we begin to decide what it is we want to make of ourselves.

A New Land Policy?

RECENT reports indicate that a national land policy will be submitted at the next session of Congress. It will probably be a fundamental part of the new farm program upon which hearings are now being held. The primary purpose is to help agriculture and safeguard the nation's future source of food.

Senator Thomas A. Benton laid down the principles of our one and only land policy in 1830. It provided for settlement of the land as rapidly as possible. This policy served the nation well. But during the ensuing years we failed to keep in step by giving permanence to our vast expanse of land. Soil erosion has, during the years, taken its toll to the extent that the national security has become involved.

E. H. Taylor writing in the September issue of *Sports Afield* has this to say about the proposed new land policy: "So it is now proposed to establish a new land policy with the definite purpose of maintaining the productivity of the nation's land. Other parts of the farm program and other agricultural policies would be geared to it. Thus, farmers would have to observe it if they wanted to benefit from these other measures. Moreover, stamped with the authority of a national policy, it would command public support in a way that conservation, as an ideal, has failed to achieve."

This is one of the most far reaching land-use proposals ever to come before Congress and is of major concern to professional conservationists everywhere.

Whose Problem is Soil Erosion?

GUNNAR M. BRUNE

GUNNAR M. BRUNE, in the article that follows, clearly points out that the results of soil erosion affect practically every segment of society. He also lists figures showing the cost of dredging reservoirs and stream channels and how conservation on the land will reduce such costs. Mr. Brune is Sediment Specialist for the Soil Conservation Service with headquarters at Milwaukee, Wisconsin.

THE INDIRECT DAMAGES caused by soil erosion affect every person in the country, farmer or city dweller. For example, if a farmer's income drops because of soil erosion and poorer yields, he has less money to spend in town, and therefore his city neighbor also suffers indirectly. Or, if the farmer is confronted with falling yields because of soil erosion, and the necessity of constantly increasing his applications of fertilizer in order to maintain them, he must charge his city neighbor a higher price for his produce. But these are indirect damages, and as such they do not greatly worry the average man in the city.

Where Sedimentation Damage Strikes

Sedimentation because of soil erosion, however, causes a wide variety of damages which strike directly at every city dweller's pocketbook. Water supply reservoirs often silt up gradually, with no visible surface evidence of the damage. When a drought year comes along, the city finds out it has a reservoir full of mud instead of water. Then special funds must be raised to excavate or dredge the sediment, or to build a new reservoir. Who pays for this—the farmer? No, he has his own well or other water supply. The man in the city pays.

Another damage, along with reservoir sedimentation, is the unnecessary cost of water purification caused by high sediment concentrations. A great amount of chemicals, power, wash water, and filtering equipment are required to filter sediment-laden water. The city taxpayer must pay for this also.

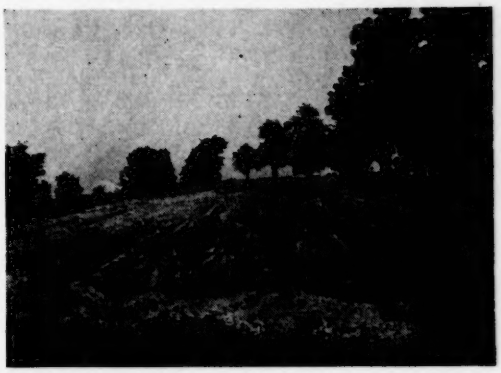

Figure 1.—An unprotected highway cut in the Iowa River watershed after the storms of May-June 1947. Thousands of miles of such ditches must now be cleaned out, many of them by hand.

Normally, power reservoirs may store water during wet seasons and use it during dry seasons by drawing down their operating head. If, however, the reservoir becomes full of sediment, water cannot be stored and water power is generated only during wet periods. It then becomes necessary to substitute steam power for water power during dry periods, and the cost of electricity goes up. The farmer pays for little of this. Only 11 percent of electricity users are farmers.

When a flood control reservoir is partially filled with sediment, it loses its effectiveness. Less and less flood water can be detained in the reservoir as sediment deposits grow. Since most flood-control reservoirs have been built for the protection of large cities, it is the city dweller who suffers when they are silted up, and the farmer suffers only to a minor degree.

Navigation channels in many of our rivers and harbors are filling at an alarming rate. Each year the Corps of Engineers is required to spend

many millions of dollars for dredging. Who pays for this damage? The taxpayer. Less than five percent of individual income taxpayers are farmers.

In addition, when river channels fill up with sediment, they are no longer capable of carrying off large volumes of water. Then cities, highways, and railways suffer from more frequent and higher floods.

EROSION COSTLY TO HIGHWAYS

The products of uncontrolled erosion are constantly filling highway and railway ditches, plugging culverts, filling stream channels under bridges, and spreading over roadways. All of these sediment deposits must be removed; usually at great expense to the state, county, or township highway commissions or railways. The sediment deposited during the May-June, 1947, floods alone in Iowa, Missouri, Illinois, and Nebraska, on highway and railway rights-of-way, will require an expenditure of upwards of $6,000,000 to remove. The results are higher taxes and railway fares for everyone, and not just for the farmer.

Most of our streams are now shallow and muddy. Sediment has filled many deep pools which once served as refuges for games fish during dry periods. Sediment deposits have covered fish spawning grounds and killed the aquatic vegetation upon which fish depend for food and oxygen. This destruction of our fish population is forcing us to go farther from home, often out of the country, to find good fishing. Swimming also has suffered. Many of our beaches have become useless because of deposits of mud. Sportsmen in general are affected, and not just the farmers, because they represent only 18 percent of our population.

After floods, cities are forced to spend enormous sums removing mud from buildings and shovelling it from the streets. Often buildings must be jacked up periodically to keep them above rising floodplain sediment deposits.

It is apparent, then, that soil erosion is not just the farmer's problem—it is a national concern for all citizens.

WHAT CAN WE DO ABOUT IT?

The sediment which causes these varied types of damage has its origin largely in sheet erosion from cultivated fields. Likewise gully erosion, streambank erosion, valley trenching, and erosion of roadside ditches and cuts contribute to sedimentation. It is now known that all of these forms of erosion can usually be reduced by 80 percent, without changing materially the basic agricultural pattern.[1]

Figure 2.—This old lithograph shows the town of Galena, Illinois, in 1856. At that time the Galena River was more than 300 feet wide, and as many as twelve or fifteen steamboats were in port at one time.

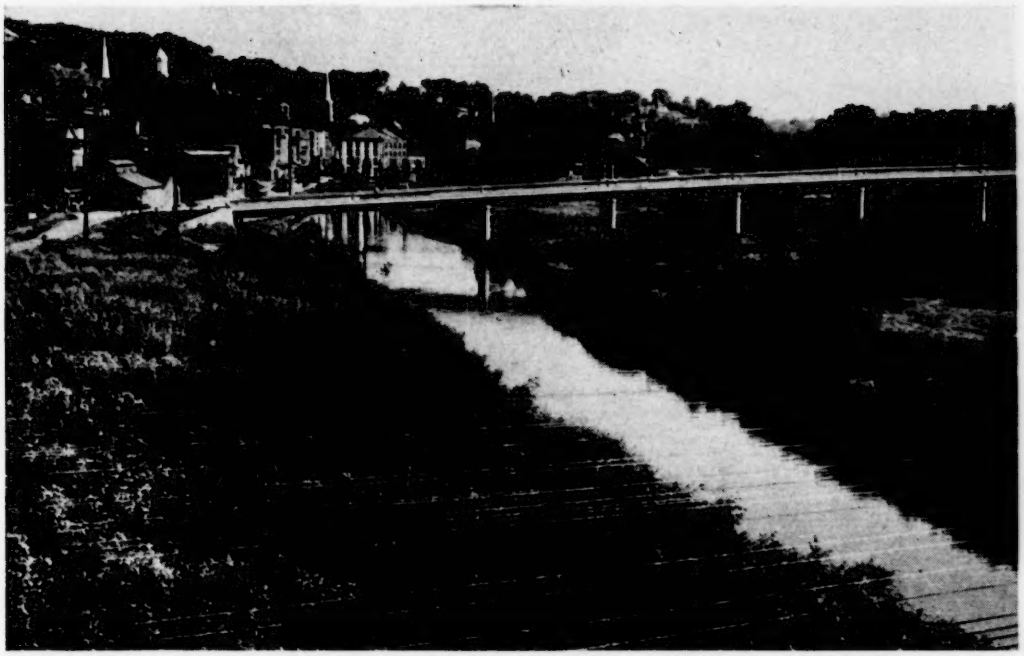

Figure 3.—The Galena River today is navigable only by rowboat. Because the channel has been largely filled with sediment deposits, the town of Galena is now suffering with more frequent floods which reach higher levels.

Small municipal reservoirs, when they fill up with sediment, are often drained and the sediment excavated with a power shovel or dragline scraper and dump truck. Present-day cost of this work, based upon studies by Brown,[2] is about $0.35 per cubic yard, or $563 per acre-foot, of sediment removed.

On larger reservoirs, it is usually more economical to remove the sediment with a floating suction dredge. Using this method, the cost runs around $0.15 per cubic yard, or $242 per acre-foot, of sediment removed.

By way of comparison, what is the cost of holding the soil on the land and preventing it's ever reaching the reservoir? The average cost of installing a complete soil and water conservation program, designed to control all types of erosion, is approximately $3.00 per acre to the Federal Government, the State, local interests, and the farmer. This is equivalent to $1,920 per square mile for installation. It is assumed that once the conservation measures have been installed, the farmer will maintain them because of the high benefits to himself. If this installation expense is changed to an annual cost continuing to perpetuity at 2 percent interest, it amounts to $38.40 per square mile annually.

A study of 41 water-supply reservoirs throughout the country shows that their average annual rate of sediment accumulation is 1.21 acre-feet per square mile of drainage area.[3] A comprehensive soil and water conservation program, such as is advocated by the Soil Conservation Service in cooperation with soil conservation districts, may be expected to stop 80 percent of this, or 0.97 acre-feet every year from the time it is installed. If an annual expenditure of $38.40 per square mile will hold 0.97 acre-feet of soil on the hillside, the cost is $39.60 per acre-foot, or $0.025 per cubic yard. In addition to keeping sediment out of the lake, this expenditure holds the soil on the farm, prevents

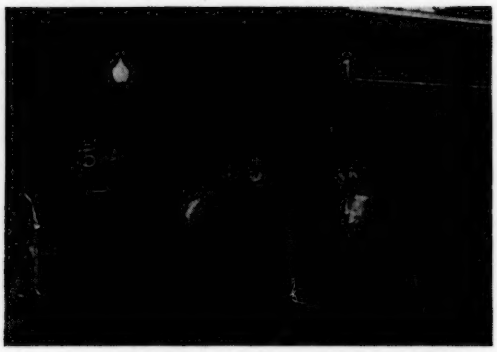

Figure 4.—Shovelling up mud in McGregor, Iowa, after a flood. Such frequent cleanups are expensive and constantly lower real estate values.

sediment damage between the farm and the reservoir, and improves swimming and fishing.

Therefore, there is every reason for a taxpayer in a city having a surface water reservoir to protest vigorously if there is even a mention of dredging or excavating sediment without conservation practices in the watershed. If the city government does not do all in its power to assist in protecting its reservoir watershed with soil conservation measures, it should not go all out for a dredging program.

MANY CITIES ARE PROTECTING WATERSHEDS

Newnan, Georgia, has reduced silting in its reservoir by about 70 percent by purchasing most of the watershed and planting it to trees (1). Roxboro and High Point, North Carolina, have reduced the rates of sedimentation in their reservoirs by 35 percent, by helping to establish only a partial soil conservation program. Decatur, Illinois, is expediting the soil conservation program in its watershed by employing full-time conservationists to work in cooperation with the soil conservation districts involved. In the Midwest a number of cities, including Springfield, Illinois; Corydon, Iowa; Akron, Barberton, Niles, Youngstown, Girard, Columbus, Swanton, Bucyrus, Caldwell, Wellington, Crooksville, Barnesville, Norwalk, and Wellston, all in Ohio, and others, have made forest plantings in their municipal watersheds.

Any taxpayer, whether in a city which maintains a surface water reservoir or elsewhere, has the right to insist that his money be spent wisely. Money spent to excavate or dredge sediment from a reservoir, stream channel, highway ditch, or city street could have been better used at a fraction of the cost to hold sediment on the land where it belongs.

In the past there has often been an undercurrent of urban-rural conflict. Farmers are naturally suspicious of their city neighbors coming out on the land to do something. City administrations are probably equally suspicious of the farmers trying to promote aid from the city. But once the farmer and his friend in the city realize that they are both suffering from the same malady, then the way is open for concerted action on the land to end soil erosion and all of the damages which follow in its wake.

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Thoughtful Americans, 150 years ago, tried to encourage the control of erosion. In 1791 the Philadelphia Society for Promoting Agriculture offered, among other prizes, the following:

> For the best method, within the power of common farmers, of recovering old gullied fields to a hearty state, and such uniformity, or evenness of surface, as will again render them fit for tillage; or where the gullies are so deep and numerous as to render such recovery impracticable, for the best method of improving them, by planting trees, or otherwise, so as to yield the improver a reasonable profit for his expenses therein, founded on experiment—a gold medal; and for the next best—a silver medal.

Financing Soil Conservation and Farm Improvements

CHESTER C. DAVIS AND DARRYL R. FRANCIS

THE AUTHORS of this article are well known in the field of agriculture. Chester C. Davis is President of the Federal Reserve Bank of St. Louis, Missouri, and an ardent conservationist. Darryl R. Francis is an Agricultural Economist and is also connected with the Federal Reserve Bank.

CHANGES IN AMERICAN agriculture resulting from technological developments are taking place at an almost revolutionary rate. Total agricultural production during recent years has averaged 24% above the 1935-39 prewar level. While much of this increase came about during the World War II period, it is becoming generally agreed that there is more behind it than an all-out war effort to meet emergency demands for food and fiber. Actually, the answer to what's back of it all lies in the technological developments during the last 20 to 25 years. More complete mechanization of farm, crop improvements such as the development of hybrid seeds, improved livestock breeding and feeding methods, and the wider adoption of soil conservation and soil improvement practices are the real forces that have created the higher level of farm production. While it is possible that the years ahead may see some slight decline from present levels, it is almost certain that the normal level of farm production in this country will remain well above the prewar level and that further technological developments will exert an upward rather than a downward pressure on farm output.

At first glance, it might appear that the recent trends in production reflect a new era of better land use and sounder soils management. To the extent that farmers are more widely accepting soil conservation programs and soil building practices, that is true. Actually, however, the balance is in the other direction. While better conservation practices are making a definite contribution, the two strongest factors behind the increased level of farm production are mechanization and crop improvements.

Mechanization has made possible more timely performance of farm work and has tended to iron out some of the inconsistencies of weather. Wet springs, that in the horse-power days meant partial crop failures, have been almost eliminated by mechanized power—thus, adding tremendously to the higher average level of production.

Crop improvements, particularly such developments as hybrid seed corn and similar improvements in other crop seeds, have given terrific petus to the increased farm production trends.

Soil Exploitation Drains Productivity

Since it appears likely that mechanization and crop improvements are the major factors involved, soil productivity losses have probably been given added impetus despite our ability to produce larger crops. The farmer is not putting into practice improved soils management technique to the extent that he has accepted improved techniques of extracting the last drop of productivity from the soil through heavier feeding crops and fewer partial crop failures. He is simply doing a more complete job of soil exploitation. This creates a more urgent need for soil conservation and soil improvement than has existed heretofore. Heavier drains on productivity must be balanced with better soils management if in the long run farm output is to be maintained at or near present levels.

The exploitive habits of the American farmer have already resulted in soil erosion losses and productivity declines almost beyond the human imagination. Agriculture has existed by cashing year by year a part of its basic capital assets. It is one of the few industries that has been able to operate under such a system. Only those industries that live through exploitation of natural resources can do so. There are definite limits beyond which agriculture cannot continue

the annual sales of basic capital assets. To reverse the trend means a re-investment of new capital in the basic producing assets of agriculture. Much new capital is required on American farms if erosion losses and productivity declines are to be reversed. Capital will be required for soil conservation practices such as the construction of grass waterways, terraces, outlet structures, and new fences to rearrange the physical farm layout with the natural lay of the land. Capital is needed to rebuild soil productivity through the addition of lime and mineral fertilizers. It requires capital to develop timber and permanent pasture on lands not suited to cultivation and to buy seeds for soil building crops for cover and green manure. Much new capital is needed for more complete mechanization of farms and further improvement of livestock and crop production.

The active interest of the Federal Reserve Bank of St. Louis in the problem of soil and farm improvement is at least two-fold. First, the research program of the Federal Reserve Bank is being geared towards the overall economic development of the District. The Eighth Federal Reserve District is largely agricultural. It is therefore logical that the St. Louis bank's interest should focus on the conservation and development of the soil resources of the District. Second, as a member of the financial community, it is interested in knowing something about the volume of new capital required to facilitate shifts to more efficient utilization of farm resources, where the new capital will come from, how it will be used, and its soundness from an investment viewpoint. These interests are behind the Federal Reserve Bank's program of individual case farm studies of soil conservation and improvement programs.

LOANS FOR SOIL CONSERVATION AND IMPROVEMENT

It seems likely that as the trend towards better soils management continues, a considerable demand will develop for loans to finance complete soil conservation and improvement programs on the individual farm. Our individual farm studies, therefore, have been designed to answer the questions of how much does it cost to place the ordinary run-down farm under a complete and well integrated program of soil conservation and improvement, what are the prospective returns from soil improvement investments, how long a time is required for the investments to retire themselves, and can credit be soundly extended to individual farmers for soil improvement work. Ultimately, our case studies must include new capital requirements for the soil improvements, and on through the operating capital needed for mechanization, household improvements, and livestock development. Logically, the first step is soil.

Without proper soil care, maximum returns can never be realized from improved machinery and livestock production. The Reserve Bank's activities to date, therefore, have been primarily confined to the soils problem in an attempt to find the answer of whether or not in cold dollars soil conservation and improvement practices pay. If so, can they be soundly financed through commercial bank loans?

There has been a wide variation in the type of practices required in the shift to a balanced system of farming, in the per acre cost of making the shift, and in the rapidity with which farm improvement investments pay for themselves. These variations are found between different areas of the district and to a great degree within relatively small communities. The most significant fact in this research to date is that in all the analyses of individual farms that have been completed, not a single instance has been found in which the investments made for soil conservation, soil building, and other farm improvement practices were not highly profitable. These variations can be best illustrated by reviewing some dollar and cents figures on the individual farms.

SOUND FINANCING FOR CONSERVATION IS PROFITABLE

On a 267 acre farm in northwest Missouri, for example, a ten-year program of converting to a sound and balanced land use program cost

Figure 1.—Contour strip cropping helps to hold the soil in place and secures the financial structure of the land.

a total of $9,714. The problem on this particular farm was primarily one of erosion control. The mineral content of the soil is reasonably high but the topography is rolling and the soil erodes badly. While some minerals are needed for maximum crop output, most of the costs of the farm improvement program here went into erosion control practices, such as terraces, grass waterways, concrete outlet structures, and new fences to line up the fields with the lay of the land. Over the ten-year period, the return from the investment was $15,655 figuring the increased yield at average farm prices for the 15-year period 1925-39, which was 96c for wheat, 73c for corn, 40c for oats, $12.50 for alfalfa hay, and $1.50 for a mature cow per month for permanent pasture. This was enough to liquidate the full cost of the program and leave the farmer an additional 50 per cent for his efforts. Based on the same average prices, the annual income from the farm was increased by $1,944 and the maintenance cost of the program, above the ordinary operating cost, runs approximately $300 per year.

Contrast this Missouri farm with a 584 acre farm located in the brown loam hill area in Northwest Mississippi on which a complete improvement program was carried out in a six-year period at a cost of $7,834 and with added returns of $12,527 for those six years that can be traced directly to the improvement investment. The cost averaged $13.41 per acre, over half of which went into lime and mineral fertilizer. Permanent improvement to the land was $6.37 per acre.

The general topography of these two areas is somewhat similar. The erosion process, however, has gone much further in the Mississippi area and a large proportion of the 584-acre farm was so badly damaged that it was fenced off to go back into timber production. In that area nature is kind and will almost single-handedly take care of reforestation if given a chance. Little cost was involved on that score. The improvement expenditures then were primarily on the lower hillsides where pasture was developed and in the valleys where some row cropping can be practiced. On the Missouri farm, on the other hand, the entire farm with the exception of a wooded pasture is capable of row crop production if a

proper soil management program is developed to protect the soil from the ravages of erosion.

BALANCED FARMING PROGRAMS ARE EFFECTIVE

Another farm located in the Black Belt that extends into Central Mississippi offers an additional contrast from the viewpoint of cost and returns from farm improvement. In a ten-year program on a 145 acre farm in the Black Belt, a total of $8,832 is required to install a sound land use and balanced system of farming. This averages a total cash outlay of $60.91 per acre, a high percentage of which goes into the mineral program. Out of the $60.91 per acre, only $17.12 represents permanent improvement to the land. Despite this unusually high investment, however, in the ten-year period $12,430 in new income could be traced to the $8,832 investment. Calculated on the same average price basis, the income from the farm was increased by $1,711 with an annual maintenance cost of $600.

To carry this analysis a little further, let us review some figures from ten farms scattered throughout the Eighth Federal Reserve district on which we have analyzed the records of farm improvement programs on a before-after and through-the-middle basis. These ten farms include a total of 2,255 acres of land with an average normal appraised value of $47.64 per acre at the time the improvement programs were started. The time involved in the improvement programs has ranged from 6 to 10 years and for the ten farms has averaged eight years. The average improvement cost per acre has been $29.28 which is approximately 61½ per cent of the original normal appraised value. However, the average per acre returns during the period in which improvement programs were being completed increased $65.47 which is a $2.20 return for every $1.00 invested in soil improvement. Of the total of $29.28 invested per acre, $17.58 represented permanent improvement to the land and raised the normal appraised value on the average from $47.64 to $65.22 per acre.

The average farm of those analyzed would be a 225½ acre farm with a normal appraised value of $10,744 at the time the improvement program was started. An addition of new capital in the amount of $6,603 would be required to complete the improvement program in an eight-year period. This investment of new capital would result in increased income in the eight-year period of $14,568, or $2.20 return for each $1.00 invested. The yearly income from the farm following the completion of the improvement program would be increased by $2,391 with an annual maintenance cost of $568 which would leave a net increase in income of $1,823 per year. The normal value of the farm would have increased to $14,708.

That pretty well gives the story for the individual farm. These studies and a pile of other evidence are convincing proof that, morals or ethics aside, from a cold business standpoint, the man who controls a farm cannot afford *not* to start now on a complete and integrated program of conservation farming.

CAPITAL NEEDS IN MOST AREAS ARE ADEQUATE

One more word about capital. A conservation program, generally adopted, would require a lot of it. There was a time when the lack of capital would have been definitely a limiting factor. In isolated instances that may even be true today. It is interesting, however, to project the cost of a complete improvement program on every acre of land in a given community and then lay the figure of total costs alongside bank deposit totals for the same community. In most agricultural areas the local supply of capital is more than sufficient to meet the cost of farm improvements if they were to start now and proceed much more rapidly than we can ever hope will be the case. You will find in almost every instance that bank deposits, and in many cases even the amount of uninvested cash on hand in banks, will exceed the amount of new capital that would be required to complete a sound land use program on every acre of farmed land in the community.

Now it is true, of course, that while the total supply of capital within a community may be

sufficient, there will be individual instances where the farmer lacks sufficient liquid reserves to meet the need in his particular case. He may have to resort to borrowing to carry out a sound soil improvement program. A well-planned soil improvement program carried out under the right kind of supervision is a sufficiently profitable venture to justify the ready extension of credit for its completion. Farm improvement plans can be developed and financed on a basis that will enable the farmer to repay the borrowed money from income earned directly by the improvement investments. It requires a little different type of loan than the conventional real estate loan or the crop production loan with which we have long been familiar. Lending money for farm improvement programs requires a careful analysis of the individual farm and a flexible extension of credit wherein money can be advanced in varying amounts on farm real estate mortgage security over a period of years. The repayment program needs to be geared to the income pattern of the farm, varied in amount repaid from year to year as income from the improvement investments develops.

CONSERVATION LOANS ARE BASED ON FARM PLANS

Loans for soil conservation and improvement to be soundly advanced and repaid must be closely geared to a good farm plan. The general principles laid down above will apply but loan advances, repayments, and terms will vary with the individual farm. The only way to be sure that the extension of credit fits a particular farm problem is to gear it closely to the farm plan. There have been times when it would have been impossible to make farm plans with sufficient accuracy to serve as dependable farm mortgage loan guides. Today, however, with the vast stockpile of technical information that has been developed at the Land Grant Colleges, through actual performance of farms cooperating with the Soil Conservation Service and other sources, a well-trained farm planner can sit down with the farmer and lay out a program

Figure 2.—This badly eroded field is the result of neglect. It cannot sustain a permanent agriculture without the application of proven conservation practices.

over a period of years through which costs and production increases can be accurately estimated. This makes it possible to project a realistic loan program by which money can be advanced for needed improvements and can be repaid from income that will be produced by the improvements.

Up until recent years there may have been some justification for the exploitive farm real estate mortgage practices that have persisted. With the practical knowledge that is available today, however, there is little reason for continuing many of the farm real estate mortgage loan practices which actually have encouraged poor land use. The primary offenders have been the farm appraisal policies, the slide rule method of loan amount determination, and the requirement that the annual loan balance becomes successively less from the time a loan is made. These are merely conventional loan practices that have persisted for years and are generally adhered to today. They worked reasonably well in the days when farmers first began to encounter a need for farm mortgage finance and when farm land was new. The farmer through annual liquidation of a part of his soil productivity capital could retire a loan with reasonable certainty. While these conventional loan practices actually encouraged exploitation, virgin soils could withstand the shock and farm ownership via the credit route was accomplished even though the farm when paid for in many instances was much less valuable than when the purchase was made. As time went on, however, and land values increased, total mortgage debt rose and soil productivity declined, those conventional loan practices have had an increasingly vicious effect on soil productivity. We have reached a point today where it has become difficult for a farmer who is ready to advance from a tenant to an owner to buy a good farm. New land is no longer available and in most instances, the prospective farm owner is confronted with the purchase of a farm which has already been badly exploited. Further exploitation under heavy mortgage indebtedness makes farm ownership a less certain possibility. The average farm buyer today is confronted with the problem of conserving what topsoil remains and with rebuilding soil productivity to a level that will produce sufficient income to furnish a reasonable standard of living and retire indebtedness. It seems only reasonable, therefore, that farm mortgage loan policies must be adjusted in keeping with the times if the use of credit is to continue to be a sound medium of individual farm ownership. The adjustments in farm mortgage credit policies which must be made are relatively simple. We must first recognize that the real value of farm land, irrespective of sale prices, actually increases or declines depending on the nature of practices followed on a particular farm. Here are some adjustments that need consideration:

1. Land appraisal must be adjusted to recognize the increased real value that results from proper soil conservation and improvement practices. Recognition of changes in real value will make it possible for the slide rule lenders to vary the amount loaned to cover improvement costs. The slide rule or percentage limitation practices are established by law for some lenders but there is no law that regulates the real value of land.
2. Disbursement schedules on farm mortgage loans must be liberalized from the conventional practice of one disbursement for each mortgage loan. A realistic loan program requires that a flexible disbursement schedule be adopted through which funds can be advanced to the borrowing farmer over a period of years for conservation and improvement costs in addition to the initial disbursement for purchase of the land.
3. Repayment programs must be more nearly geared to the income pattern of the particular farm being financed. Where heavy investments for soil improvements are required, these costs will usually exceed the income they produce for a period of from two to five years. This makes it impera-

tive that repayments be made flexible so that repayments are light during the period when costs are high and returns low and that the annual repayments increase in amount as income increases from the improvement investments.

4. The idea that the mortgage balance on a given farm loan should be successively less each and every year from the time the loan is made must be overcome. Actually, in many farms which require heavy improvement outlays, the year-end balance of the mortgage debt may actually increase for a period of some two to five years while the productivity level of the farm is being rebuilt.

When lenders generally accept these four adjustments from conventional loan practices and write into mortgage papers a sound soils management program, farm improvement loans will become a much more constructive influence toward individual farm ownership than has ever been true in the past. These adjustments are an absolute must if this nation is to realize its full potentialities from sound development of its farm resources.

LOAN SCHEDULES ARE BASED ON ADJUSTMENTS

The following table gives a loan schedule for the 145-acre Mississippi Black Belt farm, mentioned earlier in this article. It illustrates the four adjustments from conventional loan practices mentioned above. This is a farm which lays reasonably well but which has a soil that is very deficient in basic mineral elements. For complete improvement, it requires some erosion control practices and very heavy applications of mineral fertilizer and lime, in addition to a properly balanced cropping system. The normal value of the land without treatment is $20 per acre or $2,900 for the farm.

Line one and two gives a conventional 10-year purchase loan based on 60% of the normal appraised value of the land amortized at the rate of 4% of the original loan balance per year. Line three shows the additional disbursements that would be required on the loan to finance a complete farm improvement program. This calls for loan advances each year throughout a ten-year improvement program. Line 4 shows the repayment schedule for the conservation portion of the loan. Repayments are calculated on the basis of 75% of the anticipated increased income resulting from the improvement program. Repayments are light during the early years of the program and build up as income from improvements develops. Line 5 shows the annual year-end balance of the advances for conservation and improvement purposes. It is interesting

LOAN SCHEDULE 1

	1946	1947	1948	1949	1950
1. 60% Purchase Loan	$1,740.00	$1,670.40	$1,600.80	$1,531.20	$1,461.60
2. 4% Amortized Repayment	69.60	69.60	69.60	69.60	69.60
3. Conservation Advances	1,457.00	842.65	809.20	1,259.75	1,272.00
4. Conservation Repayment (75%)	292.20	663.38	871.12	1,079.92	1,283.18
5. Conservation Balance, yr. end	1,164.80	1,344.07	1,282.15	1,461.98	1,450.80
6. Total Mortgage Debt, yr. end	2,835.20	2,944.87	2,813.35	2,923.58	2,842.80
7. Total Principal Payments	361.80	732.98	940.72	1,149.52	1,352.78

LOAN SCHEDULE 1 (Continued)

	1951	1952	1953	1954	1955	1956
1. 60% Purchase Loan	$1,392.00	$1,322.40	$1,252.80	$1,183.20	$1,113.60	$1,044.00
2. 4% Amortized Repayment	69.60	69.60	69.60	69.60	69.60	.....
3. Conservation Advances	773.75	965.75	990.00	461.75	.....	.....
4. Conservation Repayment (75%)	1,283.18	1,283.18	1,283.18	792.51	.....	.....
5. Conservation Balance, yr. end	941.37	623.94	330.76	.....	.....	.....
6. Total Mortgage Debt, yr. end	2,263.77	1,876.74	1,513.96	1,113.60	1,044.00	.....
7. Total Principal Payments	1,352.78	1,352.78	1,352.78	862.11	69.60	.....

to note here that the maximum balance for the conservation portion of the loan comes in 1949 or the fourth year of the program and totals only $1,461.98 despite the fact that improvement costs amounted to an aggregate of $8,832. Line 6 shows the total year-end mortgage debt during the 10-year loan program and illustrates a case where the total mortgage debt remains relatively constant for a five-year period while farm improvements are being made and then declines sharply as improvement expenditures are reduced and new income develops in a substantial amount. Line 7 merely outlines the total principal payments by years throughout the ten-year program. This is a rather typical program that would be expected on lands where productivity is badly depleted, responses are relatively slow, and total costs heavy. Yet, the ultimate income returns are so great that a farmer buying this type of farm cannot afford *not* to make the additional investment. Likewise, the banker advancing money for purchase of the farm will better secure the loan and more nearly insure repayment through advancing the additional money for improvement purposes. This case represents one of the more difficult kind. Of the total of $8,832 invested in improvements, $2,483.12 represents permanent long-term improvement to the land, raising the per acre value from $20 to $37.12 per acre or for the entire farm from $2,900 to $5,383.12.

The following table gives a loan schedule for the 584-acre Mississippi brown loam hill farm previously discussed.

In this instance the purchase loan was also set up on the basis of 60% of the normal appraised value with a ten-year term and 4% amortization. Conservation advances are made for the entire cost of the improvement program. Annual repayments for the improvement portion of the loan are established at 65% of the increased income. In this case, we are dealing with a much more responsive soil where income from improvement practices develops more rapidly than in the Black Belt. The total year-end mortgage debt reaches its peak in the third year and declines sharply from that point. Whereas it required nine years for total liquidation of the improvement loan on the Black Belt farm, this one pays out in a six-year period. Of the total improvement costs of $7,834, $3,718.50 represents permanent improvement to the land, raising the normal appraised value of this farm from $40 to $46.37 per acre or of the entire farm from $23,360 to $27,078.50.

LOAN SCHEDULE 2

	1941	1942	1943	1944	1945
1. 60% Purchase Loan	$14,016.00	$13,455.36	$12,894.72	$12,334.08	$11,773.44
2. 4% Amortized Repayment	560.64	560.64	560.64	560.64	560.64
3. Conservation Advances	1,172.25	1,833.00	1,627.00	1,099.00	822.50
4. Conservation Repayment (75%)	586.13	1,308.57	806.36	1,677.10	1,872.84
5. Conservation Balance, yr. end	586.12	1,110.55	1,931.19	1,353.09	302.75
6. Total Mortgage Debt, yr. end	14,041.48	14,005.27	14,265.27	13,126.53	11,515.55
7. Total Principal Payments	1,146.77	1,869.21	1,367.00	2,237.74	2,433.48

LOAN SCHEDULE 2 (Continued)

	1946	1947	1948	1949	1950	1951
1. 60% Purchase Loan	$11,212.80	$10,652.16	$10,091.52	$9,530.88	$8,970.24	$8,409.60
2. 4% Amortized Repayment	560.64	560.64	560.64	560.64	560.64	.....
3. Conservation Advances	1,280.00	.....	.....	.....	.....	.....
4. Conservation Repayment (75%)	1,582.75	.....	.....	.....	.....	.....
5. Conservation Balance, yr. end	.....	.....	.....	.....	.....	.....
6. Total Mortgage Debt, yr. end	10,652.16	10,091.52	9,530.88	8,970.24	8,409.60	.....
7. Total Principal Payments	2,143.39	560.64	560.64	560.64	560.64	.....

(*Continued on page* 204)

Ten Decades of Annual Lespedeza

PAUL TABOR

HERE IS AN ARTICLE that traces the development and growth of a plant that has contributed much to American agriculture—especially throughout the South. Paul Tabor, the author, is Assistant Chief, Regional Nursery Division, Soil Conservation Service, Spartansburg, South Carolina.

ANNUAL LESPEDEZA is now one of the important soil conserving and forage crops of the Central and Southeastern United States. It was only an immigrant weed in parts of Georgia and South Carolina one hundred years ago. Its increasing importance during the past century has been described in part by Ravenel (19) (20) (21), Porcher (18), Pieters (15) (16) (17), Essary (6), and others. The writer believes many will be interested in a decade by decade acount of its development in this country, with estimates of its value in protecting and enriching soils. The early literature is the basis of estimates for the first five decades; personal observations of the writer and associates in the Soil Conservation Service and statistics of the United States Department of Agriculture were used for estimates of the last five decades.

Pre-introduction History

The first Lespedezas found by botanists were the native perennial species in the Southeastern United States. In 1753, one of the most common of these was described by Linneas as *Medicago virginica* (3) which can be translated, Virginia alfalfa. Other species were described as sweet vetches, *Hedysarum spps.*, or beggar weeds, *Desmodium spps.* (3). A botanist collector of France, Michaux, was the first to recognize the Lespedezas (13) as a separate genus. He named it for Zespedes (2) (7) (22), the Spanish governor of Florida during the late 1780's, but by error the governor's name was changed to Lespedez in Michaux' manual (13). The first annual species of Lespedeza was found in Japan and described as *Hedysarum striatum* in 1784, and changed to Lespedeza striata in 1841 (3). The other annual species, *Lespedeza stipulacea*, was found in eastern Asia and described in 1859 but later regarded as not distinct from Lespedeza striata, or only a variety of the latter (15).

The Decade of Naturalization, 1846-55

Common lespedeza, the unselected strain of Lespedeza striata, was accidentally introduced in Georgia and South Carolina prior to 1846. Pieters (16) supposed the introduction might have been about 1800; Ravenel (20) believed it to be later. A "specimen—about two inches long without flowers or fruit" (26a) in the Gray Herbarium is the earliest record of its appearance in this country. The specimen was sent from Monticello, Georgia, in 1846 by a young Presbyterian minister, T. C. Porter. Other early specimens in the Gray Herbarium are without dates (26b) but are known to be later than 1846. Ravenel (20) reported collecting specimens in 1849 or 1850, near Charleston, S. C., and Porcher (18) reported finding it in Fairfield District, S. C., during the early 1850's. It was also noted in Union District, South Carolina, and in Banks County, Georgia, during the middle 1850's (18) (4a). A correspondent (5) of the Richmond Christian Advocate wrote from Spartanburg, South Carolina, June 1869, giving the early history as it was known at that time:

"I allude to the Lespedeza striata, usually termed Japan clover, frequently Confederate clover. According to the most reliable information I can get, it first made its appearance at and near country stores about twenty years ago in South Carolina and Georgia. It is supposed the seed was transplanted in packages of wares from Japan where it is said the plant is found."

Others noted it first on roadsides and in drains, and spreading from there into old fields

and pastures (1) (4). Common lespedeza must have become well established at many places in South Carolina and northern Georgia by the end of 1855. Possibly the decade began with a total of ten acres and ended with five hundred. Its value for soil conservation during this decade was limited by the small acreage.

THE DECADE OF SPREAD, 1855-1865

"Up to the time of the war," the Christian Advocate correspondent (5) reported, "it had not attracted much attention nor spread to any noticeable extent; but during the war it spread as if by magic all over northern Georgia and Upper South Carolina and many counties of western North Carolina."

Another correspondent using the name Old Texan (14) reported it in Louisiana in 1864. Conditions were favorable during this decade for the spread that occurred. Open range prevailed over most of the cotton belt. Much of the abandoned crop land and crop land turned out to rest was open to grazing. The amount of idle land was very probably greater than usual during the war period, and the opportunity for dispersal of seed was provided by widespread movement of cavalry and beef animals (4a). Probably the acreage increased from 500 to a half-million acres during this decade. On this larger acreage, approximating two percent of the cleared land in its range of distribution, favorable estimates were made of its value in protecting and improving impoverished lands (1) (25) (28). Porcher (18) wrote, "It grows almost everywhere and seems to take hold even on washed and galled parts of land as if it would redeem both the looks and fertility of the country." Ravenel (20) quotes others . . . "It renovates old lands when turned under. It is admirable for preserving lands from washing." . . . "The bottoms of gullies are filled so densely that they can't wash any more."

THE DECADE OF PUBLICITY AND DECLINE, 1866-1875

The "report of Dr. L. E. Berckmans, one of the committee appointed by the Agricultural Club of Richmond County, Georgia, for the investigation of the two plants known as Lespidesa striata and the Acanthuspermum anthoides" (1), published September 25, 1867, was the "introduction to the public" (2) of the new wild clover. W. H. Ravenel obtained the complete identification of this lespedeza from Prof. Asa Gray of Cambridge probably in the fall of 1866. The common name Japan clover was suggested by Ravenel during the fall of 1867 (19). Both Berckmans and Ravenel were conservative in their estimates of the probable value of annual lespedeza but several others were not. Its promise was news to a discouraged people after a disastrous war. The value of the plant was over-estimated for that period. "It . . . disappointed the highly wrought expectations of those who took their impressions from the newspapers," and during the latter part of the decade was "seldom heard of" (21). The short growth on hill soils, the difficulty of seed harvest, without suitable equipment, some unfavorable estimates of its forage value (14) (24) (25) (28) and drought during the late spring of 1868—all probably were directly responsible for the failure of annual lespedeza to win favor with the majority of farmers. The high price of cotton and the increasing use of commercial fertilizers to boost cotton yields were indirectly responsible.

Probably the area in common lespedeza increased to 700,000 acres or somewhat more in 1867 and declined to 600,000 later in the decade. On this acreage it doubtless helped control erosion and restore productivity. Its spread by natural means was too slow and too accidental for an adequate conservation job. Apparently the suggestion of sowing a few seeds on the highest elevation of idle fields (4b) was not accepted by the farmers.

THE DECADE OF DOMESTICATION 1876-85

Common lespedeza succeeded so well on the deep loess soils of southeast Louisiana and adjacent Mississippi that it became a crop there about 1880. Capt. J. B. McGehee of Laurel Hill, Louisiana, is given most of the credit for its

domestication. Others had saved seed and sowed them on a limited area (10) (23) (25) during the previous decade, but apparently had not carried on when public interest lagged. Common lespedeza could be used more efficiently as a domesticated crop than a wild crop. It could be quickly established from seed and in this way introduced into short rotations with cultivated crops, instead of having to wait two or three years for a stand from natural spreading. The acreage to sowed lespedeza must have increased slowly. The value of natural stands of lespedeza for improving soil productivity was recognized by a few. In 1879, one of the many correspondents in the extensive survey of cotton production wrote of the benefit of Japan clover for idle crop land (9).

Probably a small increase in total acreage of common lespedeza occurred during this decade. It spread northward into west Tennessee (6) and Virginia (16). Perhaps 750 thousand acres were growing in pastures, idle fields, roadsides and on crop land at the end of the decade. An acreage about 20 times as large was needed for adequate soil conservation.

THREE DECADES OF SLOW INCREASE, 1886-95; 1896-05; 1906-15

During the 30 years following 1885, there was probably a slow increase in total acres of common lespedeza from about 750,000 to 1½ million acres. In the same period the land sowed to this crop increased from about 4,000 to 100,000 acres. Much of the latter increase came during the decade 1906-15 when the invasion of the boll weevil in Louisiana, Misssissippi and Alabama seriously reduced cotton production on "late" soils there. Some farmers of this period, using common lespedeza as a crop, developed ratations having considerable soil-conserving value (12). The natural stands of common lespedeza on idle land, pastures and meadows doubtless continued as in previous decades, some doing a good soil conserving job and some failing to adequately hold the soil and restore productivity.

THE DECADE OF NEW VARIETIES 1916-1925

Three new varieties of annual lespedeza became available to farmers of the United States during the decade 1916-1925. A tall upright selection of common lespedeza, Tennessee 76, was selected and distributed by the Tennessee Experiment Station (6). A giant strain of common lespedeza, Kobe lespedeza, and found in Japan, and increased and distributed by the Coker Pedigreed Seed Company, Hartsville, South Carolina (16). A new species, Korean lespedeza (*Lespedeza stipulacea*), was introduced and distributed by the U. S. Department of Agriculture (15). These superior kinds of annual lespedeza made possible a big expansion of the crop in the following decades.

As the new kinds of annual lespedeza were being tested and developed, the acreage of common lespedeza as a crop increased throughout the Southeast. County agents east of the recognized lespedeza area urged farmers to try the crop for hay, seed or grazing. It was highly successful as a field crop in North Carolina (16) and as a pasture crop on moist soils of Georgia (11). At the close of the decade about 400,000 acres were harvested for hay and seed and probably two million other acres were partly or completely covered with annual lespedeza. It helped protect and improve much of this acreage.

THE SECOND DECADE OF SPREAD 1926-35

The total acres in annual lespedeza is estimated to have increased from 2.4 million in 1926 to 15 million in 1935. Most of this increase occurred in the upper part of the cotton belt and northward, where Korean lespedeza proved to be extraordinarily well adapted (17) (29). A moderate increase occurred in the middle and lower parts of the cotton belt. Nematodes probably limited its use on well drained sandy soils in the lower cotton belt (27). Severely eroded soils in the Piedmont needed fertilizer and mulch to produce good yields (8).

THE DECADE OF SOIL CONSERVATION 1936-45

Annual lespedeza came into its own as a soil conserving crop during the decade 1936-45. A steady increase of acreage resulted in approximately eight million acres for seed and hay in 1945 (30) and probably twice as many acres for pasture, and cover crop On many farms, annual lespedeza became an adequate soil conserving crop. The farm of Mr. S. L. Patterson, Route 5, Rock Hill, South Carolina, is an example. In 1935 Mr. Patterson became a cooperator of the Fishing Creek Demonstration Project of the Soil Conservation Service. He was allotted 200 pounds of Korean lespedeza seed to soy five acres of sloping cultivated land. He had no previous experience with Korean lespedeza. From this beginning, seed were saved and the acreage increased until today slightly more than one-half the 110 cultivated acres is in Korean lespedeza. A few acres of the tallest growth are cut for hay and the remainder combined for seed and the leaves and straw left on the land. More than 60 tons of seed were harvested on this farm and sold locally during the decade 1936-45.

Sowing Korean lespedeza seed on the Patterson farm is no longer necessary; a dense volunteer stand appears after each plowing or cultivation. Row crops are rotated annually or biennially with Korean lespedeza either alone, or with small grain. The acre yield of cotton on the Patterson farm has been doubled during the decade, without the use of additional commercial fertilizers. An adequate job of soil conservation is being done.

Some of Mr. Patterson's local neighbors in the Catawba Soil Conservation District and many long distance neighbors throughout the Southeastern and Central parts of this country are using annual lespedeza effectively for soil protection and improvement, and for seed production and forage.

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Conservation and Research Problems in El Salvador, Central America

MANUEL CHAVEZ VIAUD

MANUEL CHAVEZ VIAUD, the author of this excellent paper, is Head of the Soil Conservation Section, Centro Nacional de Agronomia, Santa Tecla, El Salvador. Mr. Viaud spent twelve months during 1944 and 1945 training in soil and moisture conservation work with the United States Soil Conservation Service.

EXPERIMENTS IN SOIL and Water Conservation have been conducted by the Centro Nacional de Agronomia since 1945, under the leadership of Dr. Nathaniel E. Winters, Director, who worked ten years with the Soil Conservation Service in Oklahoma, Kansas, Nebraska and Hawaii before coming to El Salvador. Field trials in soil conservation research are also carried on in cooperation with farmers on their lands.

Coffee is the main cash crop of El Salvador. It is usually grown at high altitudes and much of it is found on steep slopes. Although it grows in the shade of other trees (generally Inga species) between "Izote" (*Yucca elephantipes*) barriers and has many fine surface rootlets that somewhat help to control erosion, effective means, however, to prevent runoff must be found and tested.

The Soil Conservation Section of the Centro Nacional de Agronomia is conducting several experiments to control erosion and improve the soil in coffee land. *Leguminous cover crops* are being tested between coffee rows to determine their tolerance to shade and their erosion control value under a semi-shade condition. Up to date the most promising plant seems to be the trailing indigo (*Indigofera endecaphylla*) which grows in the shade. It makes a dense protective cover and shades the soil even during the long dry season (November to April), maintaining a supply of nitrogen for the roots of the coffee. *Grass barriers,* which appear to be shade tolerant and may advantageously replace "Izote" (*Yucca elephantipes*) barriers, have been established by means of Lemon grass (*Cymbopogon citratus*). A Love grass (*Eragrostis curvula*) has also shown some promise. It makes dense protective barriers after the first year and appears to be shade resistant.

A study of *soil and water conservation methods in coffee production* has been under way since March 1946 in collaboration with the Coffee Culture Section. Dr. N. E. Winters planned this project, and, as far as is known, it is the first time that an experiment of this kind is made with coffee. The following five treatments in duplicate are being conducted on a new coffee plantation with a 10% average slope:

Plot 1 is kept clean by hand. Rectangular shallow holes have been dug and maintained above each coffee row to imitate the best customary practices of the country.

Plot 2—Shallow cultivation with implements is practiced on this plot without the shallow holes.

Figure 1.—Air view of grounds and experimental plots of the cooperative experiment station located at San Andre's, El Salvador.

Plot 3—A complete vegetative cover is left on this plot during the rainy season—May to November—and clipped about 0.20 m. high. A dry uniform vegetative cover is maintained during the dry season—November to April. An effort will be made to duplicate forest conditions by developing a natural forest mulch cover spread over the soil surface.

Plot 4—Ridge terraces have been built on the contour in this plot by means of a Ford-Ferguson outfit; shallow cultivation will be practiced between the terraces.

Plot 5—Love grass (*Eragrostis curvula*) barriers have been established on the contour. Shallow cultivation will be practiced between the barriers.

The objectives of this experiment are to determine the comparative costs of soil and water conservation methods, to study the effect of each method on coffee yields, rate of growth of trees, health of trees and on water and soil losses. An effort will also be made to repeat this experiment with coffee farmers.

Bench terraces built by hand may be found in some steep coffee plantations of the country. An experiment, therefore, on *Bench Terrace Maintenance* is being conducted at the Experimental Station. "Izote" (*Yucca elephantipes*) and Grass barriers are being tested on the edge of the terraces; cover crops on the banks. Two terraces have been left without protection to be used as checks.

Figure 2.—A trial planting of *Delichos lablab* shows luxuriant growth at the end of the six month dry season. This plant has excellent possibilities for use as forage, green manure and cover crop.

Another experiment on the *Effect of Heavy Mulches on Coffee Production* is being conducted by the Department of Horticulture in collaboration with the Soil Conservation Section. Vigor, growth and general appearance of coffee trees will be used as indices of effects of mulch, but yields will be depended upon for determining final results.

CONSERVATION IN CLEAN CULTIVATED CROP PRODUCTION

Conservation practices to protect cereals and other clean cultivated crops are being tried in the fields of the Experimental Station and on the lands of cooperating farmers.

Strip Cropping and Rotations. A 3-year rotation with corn, cotton and rice, and a 5-year rotation with sugar cane, corn, dolichos lablab, rice and cotton were started in 1946 in strips on the contour with a 4% average slope. Another 3-year rotation with corn, dolichos lablab and rice is being run between grass barriers on the contour on a field with a 20% average slope.

In order to be able to compare the yields of crops grown in strips on the contour and rotated, with the yields of crops grown continuously and not on the contour, corn, rice, cotton and sugar cane are grown continuously for five consecutive years in fields adjacent to the strip cropping.

Vegetative Barriers for Crop Protection. To test "Izote" and grass barriers in soil conservation on steep slopes every year planted to corn, "Izote" (*Yucca elephantipes*) and lemon grass (*Cymbopogon citratus*) barriers have been established on the contour in a cornfield with an average slope of 26%. An adjacent cornfield has been left without protection to be used as a check. Yields from protected crops will be compared with yields from unprotected crops.

Guinea grass (*Panicum maximum*), Elephant grass (*Pennisetum purpureum*), Dwarf Sorghum, Pigeon pea (*Cajanus cajan*) and Love grass (*Ergagrostis curvula*) barriers for bench terrace formation are also used on different

slopes. Crops are being grown between the barriers. Observations will be made on the time needed to establish a dense protective barrier with the different plants and the time necessary to establish an effective bench terrace.

Meadow Strip Protection. Grasses and legumes have been planted in natural draws to find out which plants are the best to protect waterways against erosion by flowing water. Observations are being made on resistance of plants to running water and on the time needed to make a good protective cover.

Stream Bank Protection. The banks of a river which were being undermined by the water were sloped (4:1) and planted to Para grass (*Panicum purpurascens*) in November 1945. The grass (Figure 3) has made a dense cover and no erosion has been observed.

Figure 3.—Erosion control on the banks of the Aguas Calientes River has been attained by sloping and planting to Para grass (*Panicum purpurascens*).

Reforestation. Field tests of several tree seedling species grown in nurseries are being undertaken to select species suitable for reforestation purposes on steep land. The seedlings are planted in tar-paper bags and then later transplanted to the field. This method seems to give more satisfactory survival than when seeds are directly sown in planting sites or when seedlings with bare roots are used.

The plantations established are on hills with a 25% average slope. One plantation is on a 60% slope. Seedlings are planted with Lemon grass (*Cymbopogon citratus*) barriers on the contour, in rows parallel to the barriers. Vegetation was removed only where holes were dug for the trees. Weeds are clipped from time to time between tree rows.

Measurements of Soil and Water Losses. Four runoff plots 5 m. wide and 20 m. long will be established in a field with 25% average slope. Each plot will be provided with a runoff collector, two tanks and a multislot divisor box. A standard Rain Gage will be installed at the upper part of the field close to the runoff plots, and a 15-gallon can will be put in the first tank of each plot to measure small flows. The objective of this experiment is to determine the amount of soil and water losses per year under different soil conservation practices, and the effect of the practices on crop yields.

Cooperative Extension Work. The Soil and Water Conservation Service Section often collaborates with farmers in conducting erosion control experiments. Conservation practices are recommended and technical assistance is given to farmers who ask for it. Henequen (*Agave letonae*) in this way was planted on the contour for the first time in El Salvador.

In order to encourage the establishment of soil and water conservation practices among farmers, several circulars have been written, and distributed to the principal land owners; also published in local newspapers and magazines.

For the surface of the earth is incapable of expansion; and its resources, though great and capable of much fuller utilization, are limited. ... And the fact that the size and natural resources of the earth are fixed and limited insures that its human population cannot increase indefinitely.

— C. B. Fawcett in the SCIENTIFIC MONTHLY for May, 1947.

Exploring Soil Erosion

W. D. ELLISON[1]

W. D. ELLISON is Assistant Chief, Division of drainage and Water Control, Research, Soil Conservation Service, Washington, D. C. This article, the result of extensive research, discloses how soil erosion is accelerated by the splash of falling raindrops and other related factors.

THE PURPOSE of this paper is to explore and discuss some fundamental truths relating to soil erosion by raindrops. The results of these explorations will disclose that erosion is accelerated by the splash of falling raindrops, that this acceleration is largely affected by raindrop sizes and velocities, that some soils are more highly detachable than others and because of this they splash more readily, and that the rate of splash erosion is influenced by ground cover.

The points to be discussed in this paper can be demonstrated by the reader if he will get out two pieces of garden hose and try out the several tests described. For the first test he can smear some mud on the sidewalk and try washing it away with surface flow supplied with one section of the hose. If this job seems to be taking too long, use the second piece of hose and shoot water high into the air, so that the spray falls as raindrops into the flowing water. These falling drops speed up the erosion process and clean the walk in short order. Sometimes when there are no drops falling, but only the surface water flows across the soil, there will be no erosion at all. The runoff may look clear and almost fit for drinking. But when falling raindrops strike the surface the water is made very muddy. Such results demonstrate the first of the four fundamental truths we wish to explore and discuss. This is:

Erosion on soil surfaces is accelerated by the splash of falling raindrops.

Sizes and Velocities of Raindrops Affect Erosion

The nozzle on the hose can now be set so that the water which is shot into the air falls back to the surface slowly as very fine drops. These cause only slightly more erosion than does the surface flow acting alone. Next (in contrast to the small drops which fall at low velocities) adjust the spray nozzle so that very large drops will fall at high velocities. These greatly accelerate the erosion of sidewalk mud. This contrast in sizes and velocities of drops has disclosed a second fundamental truth: This is:

Erosion on the soil surface is accelerated by increasing sizes and velocities of drops.

There are great differences in natural rainstorms. Some are composed of large drops driven in at high velocities, and some are composed of small drops which fall at low velocities. Before we can develop cause and effect relationships in soil erosion processes, we have to evaluate differences in impacts which splash on the soil surface and accelerate the erosion.

When raindrops strike the surface of a soil, they detach small particles and crumbs and splash these into the air (Figure 1). It has been found that the amounts of soil thus splashed are very sensitive to changes in raindrop characteristics; such as drop-sizes, drop-velocities, and rainfall intensities, and that a heavy beating rain may splash more than 100 tons of soil per acre into the air.[1] It has also been determined that changes in the effective ness of falling raindrops which cause splash

[1]"Studies of Raindrop Erosion," by W. D. Ellison, Journal of Agricultural Engineering, April and May issues, 1944.

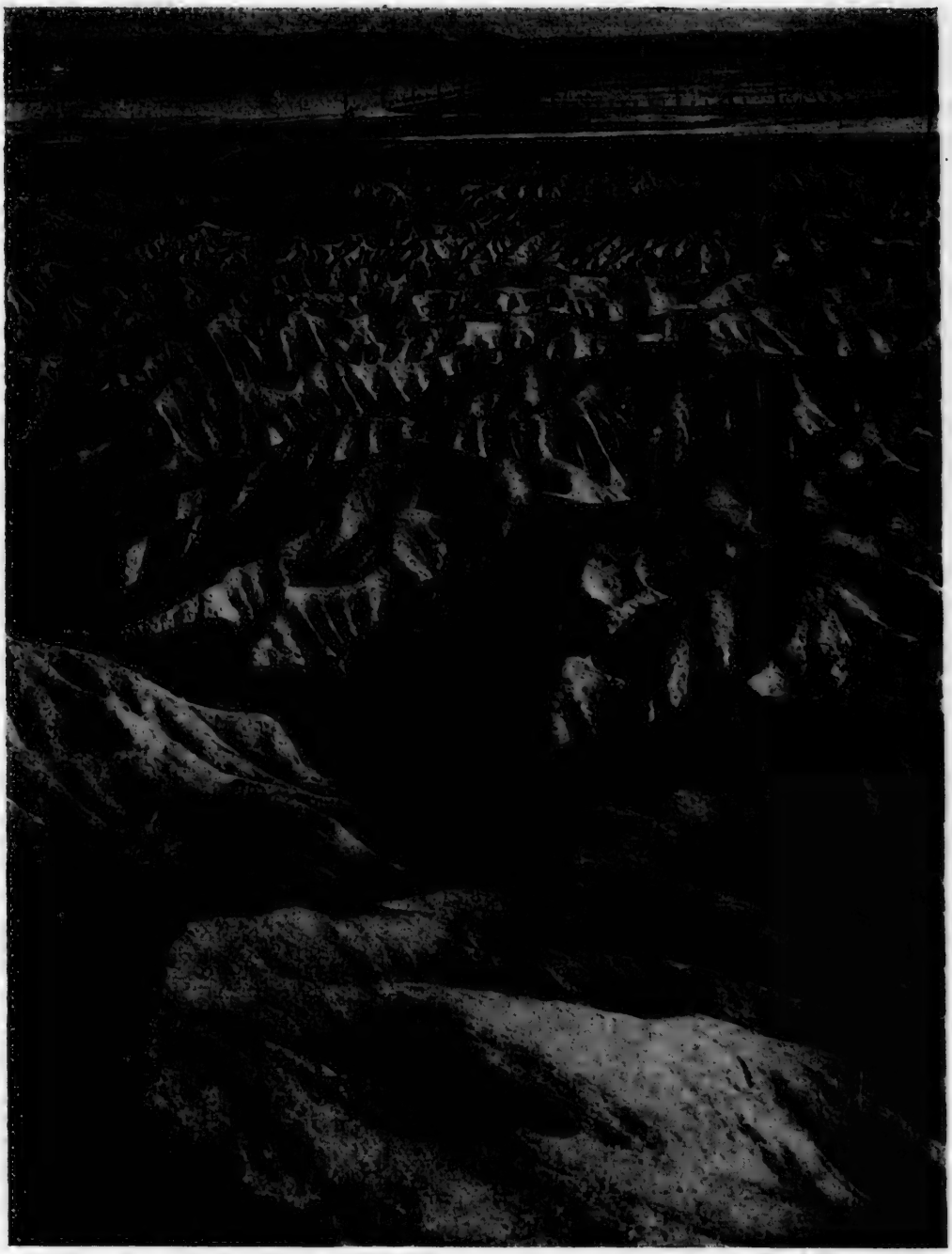

Photo Soil Conservation Service

This is the kind of topography that was eroded to cause the badlands. There is a layer of six to eight inches of topsoil over the Brule clay here. Various kinds of grasses do well and make fine grazing land. Some of the land is cultivated, but the odds are against a good crop.

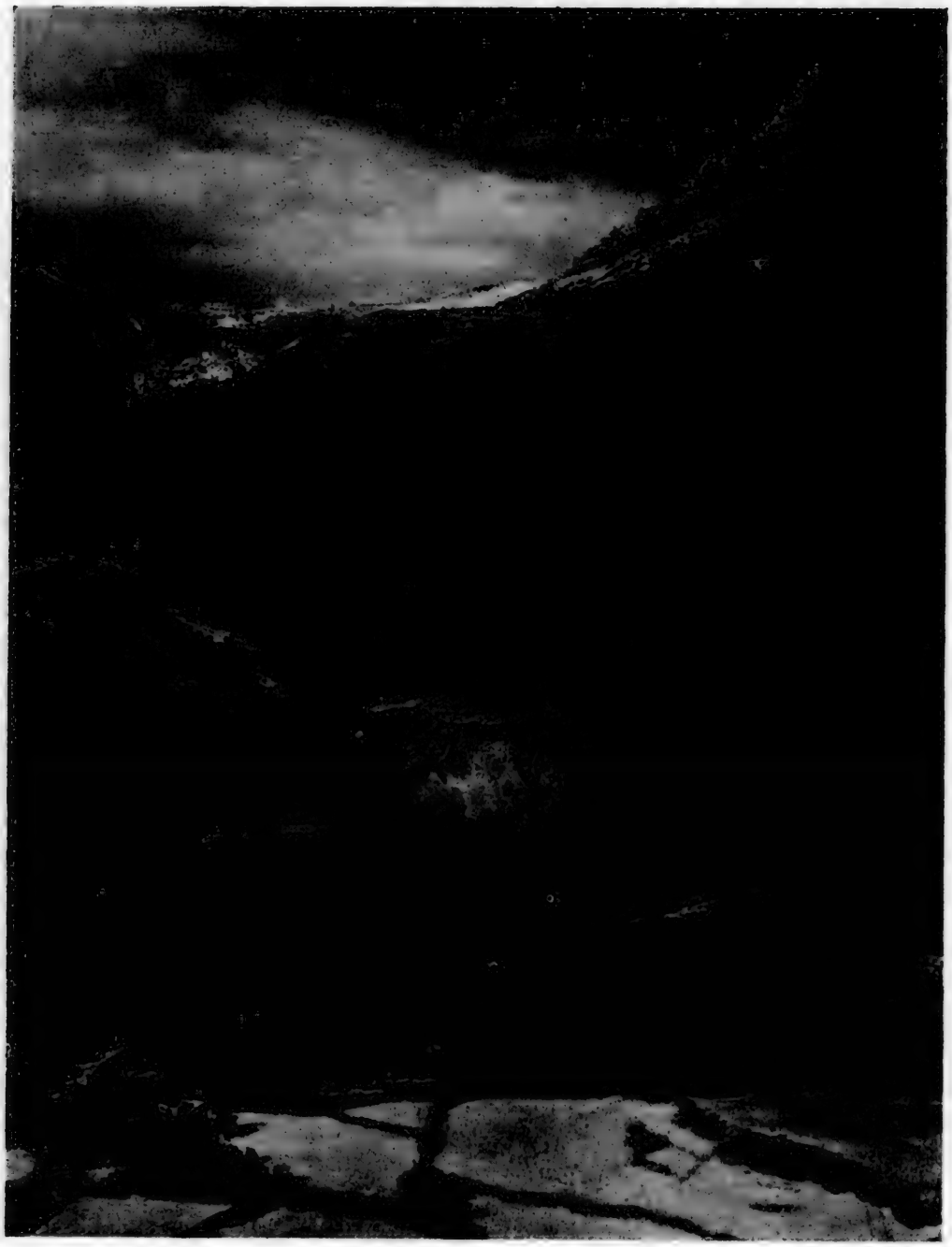

Photo by F. G. Renner

The urgent need for food in Greece has forced cultivation up the slopes, sometimes to the very tops of the mountains. Already erosion has caused as much as a fourth of the cropland to be abondoned in some areas, and unless corrective measures are taken, conditions of poverty in Greece may be expected to get worse, instead of better.

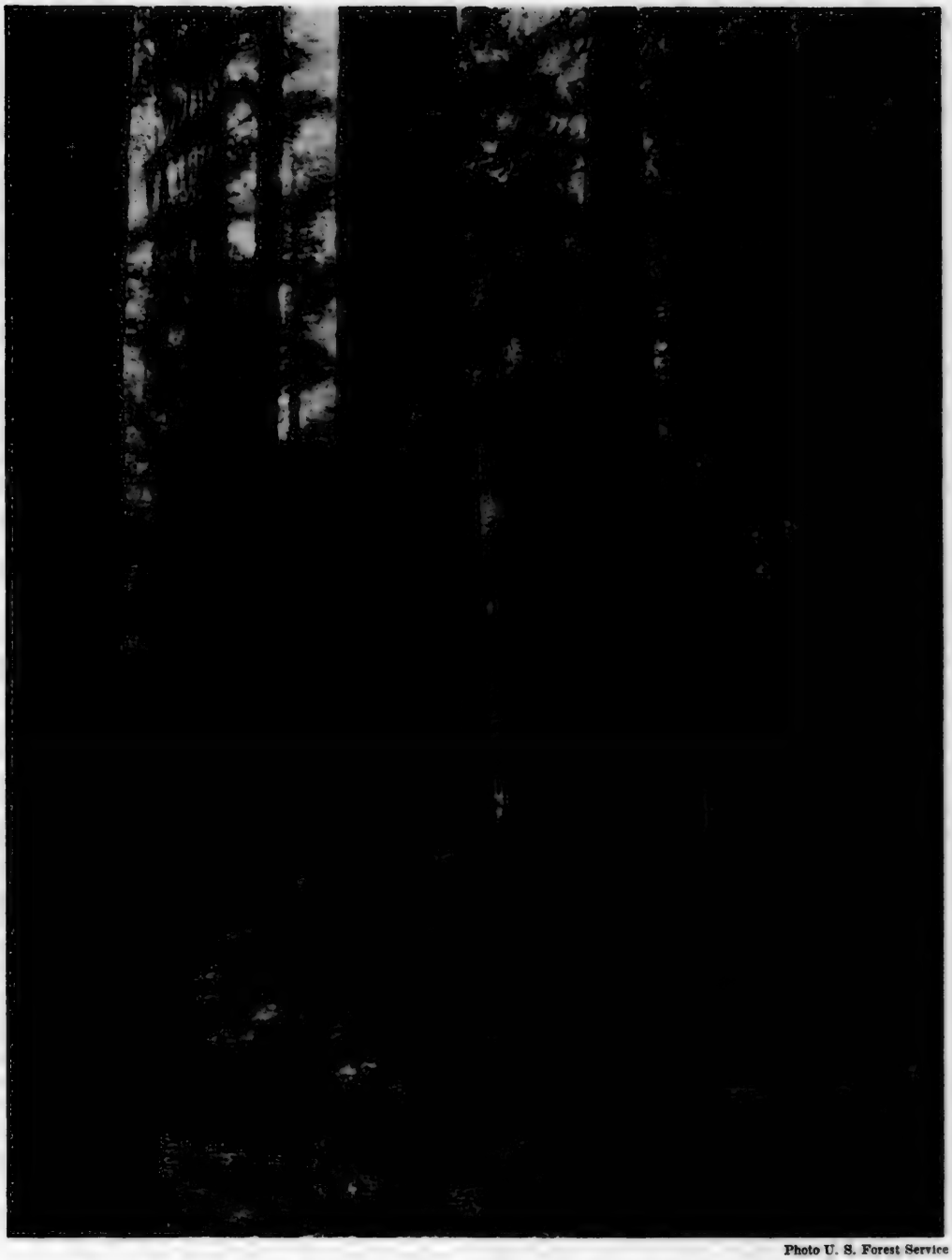

Photo U. S. Forest Service

Giant Redwoods—a heritage for all America, never to be replaced if destroyed. Many of the Redwoods are 2,000 years old, and are more than 350 feet high. They are the tallest of all trees.

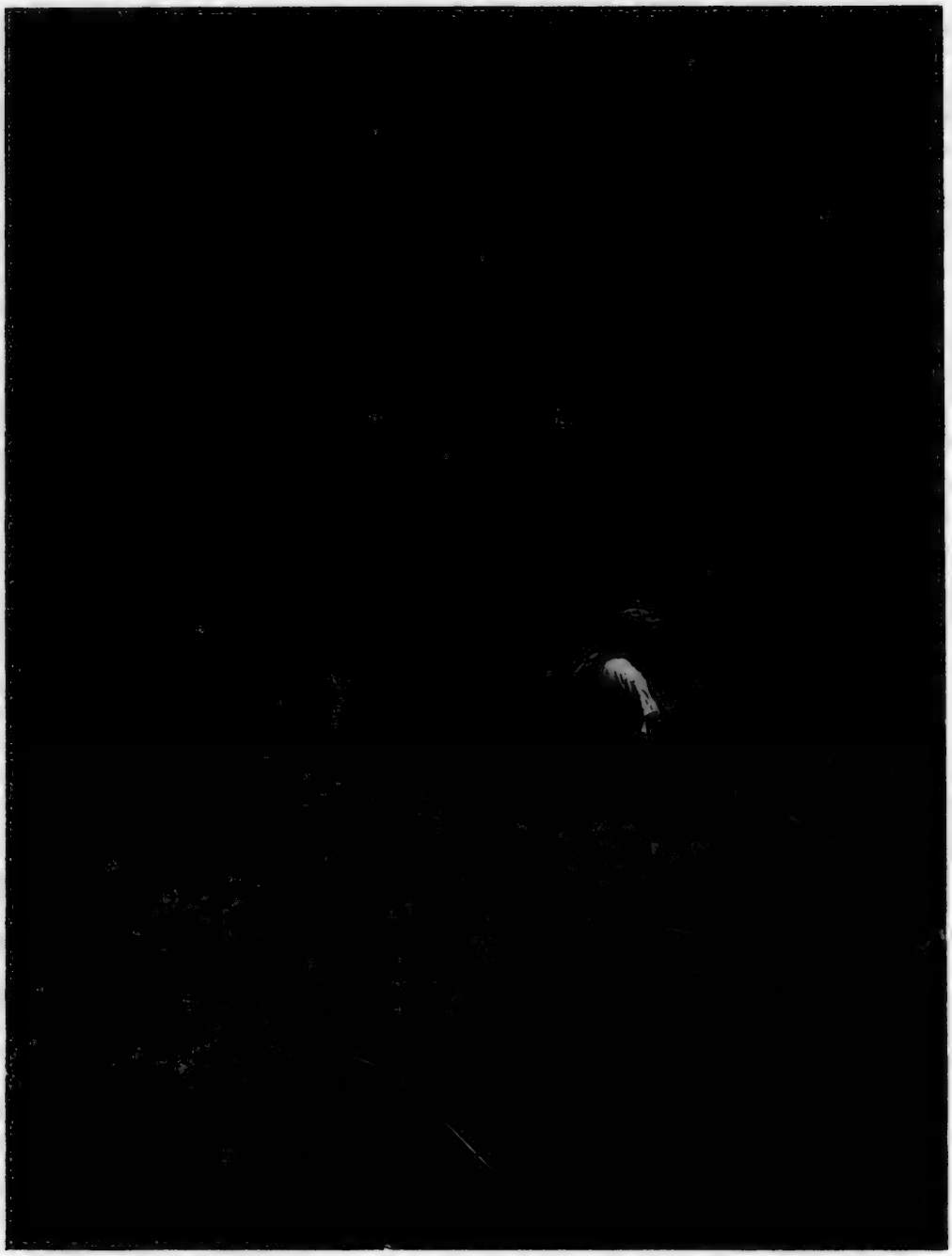

Photo by F. G. Renner

Crudely terraced wheatfields in Greece about to succumb to uncontrolled erosion. The fill of loose soil in the foreground represents tons of material washed from the slope behind the camera during the course of the preceding winter.

Figure 1.—When raindrops strike the surface of a soil, they detach small particles and crumbs and splash these in the air.

erosion, can be detected by measuring the splashed soil.[2]

Differences in splash which are caused by differences in raindrop characteristics can be further demonstrated by filling two cans (such as quart tomato cans) with soil and spraying them with the two sections of garden hose. These cans will be referred to as cans A and B, and they should both be filled with like soil and each filled to make the soil even with the top of the can. The nozzle which sprays can A will be adjusted to make large drops. The nozzle which sprays can B will be adjusted to make small drops. There will be much more soil splashed from can A than from can B. This test suggests a way of measuring differences in the detaching (splashing) capacities of falling raindrops. In experimental work this is done by filling cans A and B with a standard soil, one that will splash at uniform rate so long as the rainfall remains uniform. The standard soil selected for this work is a clean sand that will pass through a 60-mesh sieve and be retained on a 70. The operation of this equipment was explained in another article.[2]

[2] "Soil Erosion Studies—Part II," Agricultural Engineering, May 1947.

The raindrop capacities to splash soil are expressed in terms of the number of grams of standard soil they will splash out of the can. A beating rainfall that splashes 100 grams out of the can has a capacity of 100, and a much lighter rainfall that splashes only 10 grams from the can has a capacity of 10. This provides a way of evaluating the detaching capacities of falling raindrops which make up the various rainstorms.

Variations in Soil Detachability Affect Erosion

If we now select two widely different soils, (such as a sandy loam and a heavy clay), and make a mud smear on the sidewalk with each of these, and apply water with our two sections of hose, we shall usually find one of these to be more difficult to remove. There will probably be some differences in any two different soils we select. These facts point to our third fundamental truth about soil erosion:

Some soils are more highly detachable than others; that is, separate crumbs and particles of transportable sizes are more easily torn loose from the soil mass.

If we now go back to our two cans and place a different soil in each and set them close together, we can use one hose to make a uniform spray over both. The soil of lowest detachability will lose least through the splash process, and the soil of highest detachability will lose most. Equipment and procedures for making these tests were described in another article.[2] Our tests with the hose may now be carried further and the results will work out about like this: Three cans will be needed. One is filled with the sandy soil which may lose 60 grams by splash. A second can will contain the clay soil and this may lose 20 grams by splash. The third can will contain the standard soil (sand) and this may lose 100 grams through splash. If we assume the standard soil has a detachability of one, then the detachability of the sandy soil will be $60/100 = 0.60$, and the detachability of the clay will be $20/100 = 0.20$.

This detachability factor represents the proportional part of a ton of soil that will be splashed by the same rainfall that will splash one ton of standard soil.

We can now apply our findings to fields of these soils and find how much splash will occur on each. The results can be converted to tons per acre by relating the surface area of the soil in the can to the surface area of one acre. If a can of 3½ inches diameter is used,[2] the soil loss in grams is multiplied by ¾ to convert to tons per acre. The calculations for determining how many tons per acre of each of the above soils will be splashed, are as follows:

The splash erosion process is sensitive to variations in cover, and the magnitude of the splash process will vary with the effectiveness of the cover.

This effectiveness of different covers can be tested by using two small adjacent plots, A and B. On plot A there will be no cover at all. On plot B a crop will be growing. The soil surface in both plots shall be covered with about ½ inch of standard soil. Our comparison, after raindrops are applied, will be a comparison of how much of the standard soil is splashed on each plot—one with cover that is to be tested, and one without the cover. Suppose

Figure 1.

Splash in tons of soil per acre	=	(Detachability of soil)	×	(Detaching capacity of raindrops)	×	(¾)		
		or, for the sandy soil listed above						
Splash in tons of soil per acre	=	(0.60)	×	(100)	×	(¾)	=	45 tons/acre
		and, for the clay soil listed above						
Splash in tons of soil per acre	=	(0.20)	×	(100)	×	(¾)	=	15 tons/acre

GROUND COVERS AFFECT EROSION

If we now return to the mud on the sidewalk, where raindrop impacts are so effective in causing soil to be removed, we can introduce another factor into our tests. For this purpose, straw may be spread over the soil. In the first test the surface will be well covered with straw, and for each succeeding test additional amounts of straw are removed. Here we find that splash erosion increases each time straw is removed, and so we arrive at a fourth fundamental truth applying to our problem:

that where there is no cover at all, 100 grams of soil are splashed, and under the cover only 20 grams of soil are splashed. The value of the cover is then 100/20 = 5. This means that on a field this cover would reduce the splashing effect of the falling raindrops to one fifth.

Now we can carry the solution of our problem in Figure 1 a little farther by writing:

Figure 2.

Splash in tons of soil per acre	=	(Detachability of soil)	×	(Detaching capacity of raindrops)	÷	(Value of cover)	×	(¾)		
		or, for the sandy soil								
Splash in tons of soil per acre	=	(0.60)	×	(100)	÷	5	×	(¾)	=	9 tons/acres
		and, for the clay soil								
Splash in tons of soil per acre	=	(0.20)	×	(100)	÷	5	×	(¾)	=	3 tons/acres

Thus far we have discussed only the detaching of soil by the splashing of falling raindrops. Surface flow, too, detaches soil, but space will

(*Continued on page* 204)

Increasing Farm Income Through Land Improvement

KARL S. LANDSTROM

KARL LANDSTROM'S article is based upon an economic study of land development and conservation practices in a small area in the State of Washington. The study was conducted by Carroll H. Dwyer, Agricultural Economist, Soil Conservation Service, assisted by the author. Mr. Landstrom, however, assumes full responsibility for the views expressed herein. The author holds the position of Agricultural Economist for the Bureau of Agricultural Economics, Portland, Oregon.

PERHAPS NONE of the objectives of current farm programs has received such wide endorsement from farmers as has the goal of conservation and improvement of the basic land and water resources. Yet often there are obstacles that retard or prevent the application of needed measures on the individual farm. One of these obstacles is the belief of some farmers that the costs of needed measures would be excessive in relation to the benefits to be realized, or that these measures would reduce farm income, at least over a short period of time. Such a belief, unless overcome by other considerations, is apt to preclude the adoption by the farmer of measures that are needed from the standpoint of resource conservation and improvement.

On low-income farms, with farm receipts barely enough in ordinary times to pay for farm expenses and meet minimum family living costs, any reduction in annual net farm income because of added costs can hardly be countenanced by the farmer unless it can be offset by income obtainable from convenient and practicable nonfarm employment or other outside sources of income. The attitude of the farmer as to the financial consequences of adoption of a conservation or land improvement plan may be said to exercise a decisive influence.

Area Selected Is Typical for Study

The Glenwood area, in Klickitat County, Washington, is an example of an area in which the application of recommended land improvement measures involves but little cash outlay and promises to increase farm income with only a year or two of waiting. Some practices, such as the application of commercial fertilizer, would increase farm income in the first year. In an area such as this, if there is public understanding of the financial advantages of land improvement, adverse attitudes should be relatively easy to overcome. The application of needed practices should be forthcoming without the need of special financial assistance. Required, of course, would be the availability of localized technical and educational assistance in the development of sound farm plans and the selection and efficient application of specific adapted practices. Such assistance is now available in this area through the Underwood Soil Conservation District and cooperating government agencies.

The Glenwood area is a structural basin high in the foothills of the Cascade Range, located on the southeastern slopes of Mt. Adams. The basin was settled over 50 years ago during the period of pioneer development of the Pacific Northwest. The original 160-acre homestead remains a common size of farm, and a size judged necessary as an economic operating unit for a family farm on soils of average productivity. An extensive-type hay, grain, and livestock economy is predominant. Intensification with crop specialties has been impracticable because of the climate, which may bring killing frosts during any month of the year. Another factor is the shortage of irrigation water dur-

ing most of the growing season. The irrigation water supply thus far developed is inadequate, and no other sources seem to be available at reasonable cost.

NEED FOR FORAGE IS GREAT

One of the most pressing problems of farming in this basin is to obtain enough winter forage to support an adequate herd of beef or dairy cattle. There is a lack of good-quality legume hay, requiring shipments in from lower elevations. Pasture improvement is an important consideration because of the short pasture season and the need for maximum hay production, but it is difficult to obtain a good stand of improved pasture grasses on the coarse-textured soils that are subject to alternate freezing and thawing. Often a good stand is obtained one season only to have it "heave up" and die during the winter. Access to adjacent woodland range in the national forest or on privately owned woodland is desirable to permit a maximum of farm-produced forage to be harvested as hay.

The successes and failures of many years in this basin have led to the present pattern of mixed full-time and part-time farming. Jobs in the timber or in sawmills or elsewhere have been essential to many farmers, and at times even to the farmer who normally is fully employed on the farms. For simplicity, this analysis has considered only full-time farming, and has been limited to dairying, the predominant type of farming. The sizes of dairy farms selected for analysis as typical of the area range from 120 to 240 acres, depending upon the characteristics of topography and the kind of land. Typical dairy farms were analyzed for the income consequences of conservation on four of the major kinds of land found in the basin. No analysis was made for the lake-bottom soils at the lowest elevations in the basin, because the annual inundation of these soils can be overcome only by extensive-type drainage improvements requiring group action and not available as an alternative on an individual farm.

Based on experience gained in this area during the last several years, farmers and technicians of the Soil Conservation Service have indicated that measures needed on the four kinds of land considered in this analysis would include irrigation and drainage improvement and better management of crop and pasture land. These measures are not expensive. The initial or investment cost per farm would range from $1,500 to $1,900 (at average unit rates), and this would pay for heavy leveling to improve irrigation water distribution, other irrigation and drainage improvements, and additions to farm buildings needed to accommodate a larger sized dairy herd. The annual costs, considered as current farm expenses, would include the purchase of extra seed and fertilizers and increases in various items such as truck and tractor expense as influenced by the new program.

CONSERVATION BENEFITS INCREASE YIELDS

Looking at the benefits side, the experience thus far indicates that the measures would stand a good chance to increase yields substantially. One factor contributing to soil depletion in this area has been the practice of selling barnyard manure off the farm to orchardists at lower elevations. The application to depleted soils of barnyard manure or commercial fertilizer on farms cooperating with the Underwood Soil Conservation District has been reported to have caused a marked increase in crop yields and pasture-carrying capacities. Based on experience, the average effects of improvement measures on crop and pasture yields have been estimated, as shown in Table 1. These estimates are sufficiently reliable to be used in making advance estimates of farm income through budgeting.

FARM INCOME IS INCREASED

Assuming no land-improvement measures, net family farm income was computed at only $601 to $915 for four typical dairy farms. This is at or below a minimum level for adequate family living. The application of recommended measures would serve to increase these amounts by from $310 to $645 per year, after deducing interest and depreciation on the fixed improvements required by the program. The increase in income was due to the enlargement of the dairy

TABLE 1.—Estimated average crop yields and carrying capacity of pasture lands for four kinds of land in the Glenwood area, Washington

Item	Unit[1]	Kind of land[2] 1	2	3	4
Before introduction of land-improvement measures (per acre):					
Oats	Bu.	35.0	50.0	35.0	40.0
Seeded hay	Tons	.8	1.2	1.0	—
Native hay	Tons	.8	1.2	.8	.8
Rotation pasture	A. U. M.	3.0	3.5	3.5	2.0
Native pasture	Tons	2.0	2.5	2.0	2.0
After introduction of land-improvement measures (per acre):					
Oats	Bu.	50.0	60.0	50.0	50.0
Seeded hay	Tons	1.5	2.5	2.0	1.5
Native hay	Tons	1.0	1.5	1.0	1.2
Rotation pasture	A. U. M.	4.0	5.0	4.0	2.5
Native pasture	Tons	3.0	3.0	2.5	3.0

[1]A. U. M. is the abbreviation for "animal-unit month," defined as sufficient forage to maintain a mature cow or horse in good condition for a period of one month. The specific animal-unit equivalents used in the budgets in connection with feed requirements were as follows:

Dairy cow producing 220 lbs. butterfat	1.20 a.u.
Dairy cow producing 240 lbs. butterfat	1.24 a.u.
Dairy heifer, over 1 year	.75 a.u.
Dairy heifer, under 1 year	.35 a.u.
Dairy bull	1.00 a.u.

[2]The kinds of land designated by these numbers are described briefly as follows:

1. Coarse textured surface soils with undulating or slightly hummocky topography. Subsoils moderately coarse, with cemented layer 5 to 10 feet below surface. Trapped drainage throughout.
2. Medium textured surface soils with relatively level topography. Cut by drainageways. Subsoils sandy to gravelly with a moderately cemented clay layer. Some trapped drainage.
3. Medium to heavy textured surface soils with gently sloping to rough or hummocky topography. Cemented clay layer at very shallow depths. Subject to spring overflow and seasonal inundation.
4. Medium textured surface soils with gently sloping to steep topography. Subsoils gravelly clay. Also poorly drained medium textured surface soils of nearly level topography overlying a cemented clay subsoil at shallow depths.

herd by four to eight cows per farm. This was made possible largely because of increased crop and pasture yields through leveling of irrigable land, local drainage of wet land, and improved pasture management. The recommended measures, without overtaxing the farm's financial structure, would provide an opportunity to increase the size of farm business and in average times would raise net income above a minimum requirement for family living.

The Glenwood area has been characterized by frequent dependence of farmers upon nonfarm employment in the lumber industry. The farmer must weigh the advantage of larger size of business from a land-improvement program against the disadvantage of the reduced time for nonfarm employment that such a program would entail. Land improvement has its greatest advantage on farms having good soils on which the available labor is underutilized. On the poorer land types with the least yield response to land improvement, it would probably be unwise to give up steady nonfarm employment for the purpose of building up full-time farm employment.

Farm budgets, based on four typical farm operations, and using estimated factors and rates believed to be typical of the Glenwood Area, indicate that substantial increases in farm income can be realized on farms that adopt recommended land-improvement practices. The increases are possible because the gain in farm receipts made possible by land improvement is more than enough to meet the higher total costs of production, including a charge for interest and depreciation on investment in fixed farm improvements required as a part of the program. The amount of these increases in income, even on the poorer land, is sufficiently large to indicate that the application of measures currently recommended for the basin would involve little risk of financial failure even though the yield responses actually obtained would turn out to be substantially less than those assumed in connection with the farm budgets.

(*Continued on page* 206)

FINANCING SOIL CONSERVATION

(*Continued from page* 186)

LOANS FOR IMPROVEMENT PURPOSES

These two examples of how loans can be extended for improvement purposes in addition to the conventional purchase loan illustrate the four suggested adjustments listed earlier.

First, a controlled reappraisal procedure is accepted through which permanent improvements added to the land are reflected in appraised value. This enables the banker to advance all the cash costs necessary to a sound improvement program in addition to the conventional purchase loan and to keep the total loan balance within 60% of the normal appraised value. Flexible disbursement schedules are set up according to the planned program and repayments on the conservation advances are geared to the income increases that are expected from the planned program. Total mortgage debt is allowed to increase or to remain relatively constant during the period that the improvement program is being completed. The important point is that while in some instances the total amount of credit required for improvement purposes may be a relatively small amount, to the farmer investing all his available liquid assets in the down-payment on a farm, a small amount of additional credit may well mean the difference between a starvation operation and a highly profitable farm program.

It is not difficult to see the benefits that accrue to the farm buyer if purchase mortgages are made to include sound soils management programs. The community, too, has something to stake in such a program. Multiply the income increases from this type of program on one farm by hundreds for the community, tens of thousands for the state, and millions for the nation and what do you get? Vastly increased returns, reduced cost of production, and larger profits even at the lower price levels we shall one day see. In the aggregate, a land that is at long last adjusting itself to eternal fruitfulness.

Figure 3.—A sound financial program depends on how well soil erosion is controlled.

EXPLORING SOIL EROSION

(*Continued from page* 200)

not permit us to discuss that here. Surface flow cuts rills and gullies, whereas splashing raindrops cause sheets of soil to be removed.

Soil detachment is one of two hazardous processes involved in soil erosion. The other is soil transportation. Detachment hazards will depend on how detachable the soil is and how much detaching capacity (power to detach) is applied to the soil. The transportation hazards will depend on how transportable the soil is; how much transporting capacity the erosive agents possess; and how much resistance the surface conditions provide for impeding the transport of eroded materials. For example, sand particles will be less transportable than clay particles; the surface flow will have greater transporting capacity on steep slopes than on gentle slopes; and an irregular surface will offer more resistance to the transport of eroded materials than will a smooth surface.

By treating the different agents of erosion (such as raindrops and surface flow) separately, and by taking up the functions of the soils detachment and its transportation separately, we shall improve our understanding of soil erosion processes. Such an improvement is certain to lead to more effective measures for control of erosion.

A Conservation Fundamental

EDWARD H. GRAHAM

THIS STATEMENT by Dr. Edward H. Graham, author of "Land and Wildlife," presents a new conservation concept that broadens the scope of all definitions of soil conservation stated in preceding issues of the JOURNAL. Graham's "Conservation Fundamental" is basic and must eventually be recognized by conservationists and leaders in all walks of life throughout the world.

THERE HAVE BEEN several definitions of soil conservation stated in this JOURNAL. For purposes of defining the field of activity encompassed in the term, this is essential. It is also desirable from the standpoint of clarifying the objectives of the Society. In a larger sense, however, soil conservation cannot be separated from the major effort that has been taking shape to conserve all of our natural resources. We are slowly coming to realize that iron, oil, aluminum, trees, water, soil and other of the earth's useful materials must be managed with all the scientific skill of which we are capable. Our industrialized methods have made resources available to us in ever increasing amounts, but those same methods are proving how wasteful we are, and how limited are the resources. Now we see that the pennies in the bank are not without number.

Soil conservation, like the conservation of every resource, can be accomplished by intelligent effort. We can reduce wind and water erosion by learning land-use techniques that do not permit reckless loss of soil. We can check soil loss by using each parcel of land for its best adapted purpose—tilled land where cultivated crops do not damage the soil, pasture where pasture is permanently productive, forests where trees are best, and so on. We can further this work by a growing recognition on the part of the people—urban and rural—that it is important and necessary to use our land as well as we know how.

ECONOMIC FACTOR NOT FUNDAMENTAL

Let us suppose that the day will come when we shall use the land well. This is reasonable, for what has already been done in many parts of the United States demonstrates what can be done throughout the country. Appropriate methods can be applied in other parts of the world. It may be largely a matter of time until sound methods of land use are generally applied. The way has been shown. It has been shown, however, under a given set of conditions —those of the present. Conditions are subject to change. The amount of energy, in terms of men and machines, employed to utilize resources, will change conditions. Economic pressures also change conditions, and the use of the land often changes with them. In spite of the emphasis so often placed upon the economic factor, however, it is not the fundamental one. Regardless of cost we must have food to eat, shelter to protect us, and other essentials of survival. These things all come from the earth—from the environment in which we live. They are the world's resources.

The natural resources of the world are limited. The quantities of oil, iron ore, tungsten and lead were determined long ago by the geological development of the earth. There is less of them now because we have been using them. Forests, waters, productive soil, and wildlife are less now, although intelligent use can maintain a reasonably stable quantity of them. That quantity, however, cannot be brought above a limit determined by geology, physiography, climate and other environmental conditions. The way we use available resources determines what we can obtain to feed and shelter us and provide us with the necessities of living.

LEVEL OF LIVING RELATED TO ENVIRONMENT

Our level of living depends in part upon what our use of the environment provides.

As already intimated, there is reason to believe that we help bring the level of living into equilibrium with available resources as we learn to stabilize our use of land. Yet there is another highly significant factor in this relationship. It is the number of people to be supported by the products of the land. An environment supports a given number of individuals in a given condition. The condition of the individual—the level of living—results from the relation of the environment to the number of individuals to be supported. This can be expressed by an equation:

$$L = \frac{E}{P}$$

L equals level of living; E equals environment; P equals number of individuals or population.

Examination of this equation raises interesting questions. With the environment set at a limit above which it cannot be raised, the level of living can be maintained only if the number of people remains the same. Bu the number of people does not remain the same. As a species, man has probably existed 1,000,000 years. Within the last century, his numbers have approximately doubled. With environment detedmined, and numbers of people now increasing rapidly, does it not follow that level of living must decline?

CONSERVATION IS BASIC TO WELFARE OF PEOPLE

The soil conservationist, like every other practical conservationist, has a significant job to do. It is his task to assure us that the productive capacity of the environment is maintained. This Herculean task will require all the technical capacities he can bring to bear upon it. But a still broader task confronts us. Politicians, economists, teachers, sociologists and all the international organizations we have appointed to improve the lot of nations must recognize this fundamental: *That the welfare of people is a function of their number related to the capacity of the environment to support them.* Without this essential relationship in mind, other matters tend to divert us from the basic issue. Soil conservation is a part of this issue, a part of the whole great effort man must make to fit himself to the environment in which he lives. Unless we have the ability to do this, conservation falls far short of its mark and man may well go the way of the dinosaurs and countless other species that have gone before him.

INCREASING FARM INCOME

(*Continued from page* 203)

The budgets used in making this analysis were computed at prewar average prices for items bought and sold,[1] and thus are not representative of income possibilities from land improvement under unusually high or low price-ratio situations. Under a favorable ratio of prices received to prices paid by farmers, the benefits would be greater than under an unfavorable price-ratio situation. For long-time planning the farmer must consider the bad times as well as the good, and long-time average prices are better than current or short-time average prices for this purpose.

[1]The following prices for items sold by farmers were used in developing the farm budgets:

Native hay, ton	$ 8.00
Mixed legume hay, ton	10.00
Oats, bushel	.32
Butterfat in whole milk, lb.	.50
Veal calves, head	16.00
Cull cows for beef, head	40.00
Market hogs, head	15.00
Eggs, dozen	.25
Cull heifers, head	30.00
Chickens, head	.75

One of the cardinal considerations in Latin American land management is that in this area there exist today *some 20 to 30 million displaced persons,* on an estimate. These are displaced not in the national or political sense, but in the ecological sense. They are living on and farming land of Classes V to VIII, to adopt the terminology of the United States Soil Conservation Service, and it is absolutely essential that they be moved off the slopes if they are not to ruin almost completely their national lands.

— from an address by William Vogt, Chief, Conservation Section, Pan American Union, before the Valley Authority Conference, Washington, D. C., July 17, 1947.

Recent Research Reviews

JOHN H. STALLINGS

THE REVIEWS that follow by J. H. Stallings is a new feature in the JOURNAL. It is hoped that the projects reviewed from time to time will be helpful to conservationists everywhere. Members of the Society are urged to indicate their interest in the kind of research work that should be reviewed.

THE CAUSES AND EFFECTS OF SEDIMENTATION IN LAKE DECATUR. By Carl B. Brown, J. B. Stall and E. E. DeTurk. Department of Registration and Education, State Water Survey Division, Bul. No. 37, 1947.

Surveys of Lake Decatur on the Sangamon River, Illinois, showed a 20 percent increase in the rate of sedimentation during the period 1936-1946 as compared with an earlier period, 1922-1936. Hydrologic analyses of total inflow and frequency and duration of higher flows showed conditions favorable to decrease rather than increase in sedimentation. Study of trends in land use and erosion losses under various land uses has provided a logical explanation of the increase. The percentage of land used for erosion-producing, intertilled crops in a typical county, which contains 27 percent of the drainage area, increased from 39.0 percent in 1924 to 64.6 percent in 1943. Surveys, plot experiments, turbidity observations, and analyses of lake sediment indicate that at least 90 percent of the sediment comes from sheet erosion, mainly from fields of 2 to 15 percent slope planted in intertilled corn and soybeans. It is estimated that the soil conservation and watershed treatment program recommended in this area, if fully applied, would reduce sedimentation to 38 percent of its average rate during the 10 years, 1936-1946.

SOD GIVES SUPERIOR, INEXPENSIVE AIRFIELD. By Dr. John Monteith, Jr. The Coke Oven Ammonia Research Bureau, Inc., News and Views, Vol. 2, No. 9, August 1947. Columbus, Ohio.

Carefully-graded and well established sod is less expensive and in many ways more desirable for airfields than is pavement or oil, according to Dr. John Monteith, Jr., U. S. War Department. An Army airfield in Texas was seeded with Bermuda grass, fertilized adequately and watered with an irrigation system. The total maintenance cost on this irrigated sod for one year was $8,000 compared to maintenance cost for one year of $29,000 on a paved airfield nearby. Both fields averaged the same number of landings — 650 landing a day with light planes.

The establishment of good sod on airfields is helpful also in controlling dust and thereby lengthening the average number of flying hours per plane for each engine change.

RANGE FORAGE EVALUATION BY THE RANGE CONDITION METHOD. By R. R. Humphrey. Jour. of Forestry, Vol. 45, No. 1. January 1947.

The author describes a method of evaluating range conditions by estimating current in relation to potential productivity. The method is said to be easier to learn and quicker to apply than the standard range type by which the field worker is aided in determining classification. Preparation of these guides requires thorough knowledge of range ecology.

PULVI-MIXER NEW AID TO ROADSIDE SEEDING. By W. J. Garmhausen. The Coke Oven Ammonia Research Bureau, Inc., Columbus, Ohio. News and Views, Vol. 11, No. 8, July 1947.

An excellent grass-covering job is the result of a new method of roadside seeding and mulching being used by the Ohio Department of Highways. The use of lime, high nitrogen content complete fertilizer, mulch and proper rate and depth of seeding constitute the main steps in seeding.

Lime is applied and mixed to a depth of two inches with the soil by a pulvi-mixer pulled by a crawler tractor. A 10-6-4 fertilizer is spread over the area and mixed into the soil to a depth of one inch by the same machine. The area is then seeded and a straw mulch distributed evenly over the surface and tied down by the pulvi-mixer until grass growth keeps it stationary. Once tied down by the pulvi-mixer the straw mulch withstands traffic of the heaviest trucks.

This method of seeding may have a definite place in establishing seedings on terrace outlets, waterways and other places where it is imperative that the soil be tied down until the sod is established.

RAIN CAN MEAN RICHES OR RUIN. By Jim Roe. Successful Farming, Vol. 45, No. 7, July, 1947.

Raindrops are small, but powerful. They can work for you — or against you. The author explains how to put them to work on your team.

HOW TO RESEED ABANDONED LAND FOR PASTURE AND RANGE IN SOUTHERN IDAHO. By R. H. Stark, J. L. Toevs, and A. L. Hafenrichter. Univ. of Idaho, Circular No. 112. February, 1947.

Seeding your abandoned wheatland to grass will increase your profits. You can get 50 pounds of meat per acre where now you get only 10 pounds. You can do this at the low cost of from 55 cents to $1.60 per acre plus seed. This circular describes how this can be done.

A METHOD OF MEASURING VIGOR OF RANGE GRASSES. By J. E. Weaver and R. W. Darland. Ecology, Vol. 28, No. 2, April, 1947.

The degeneration of excellent or good native pastures and ranges into medium or poor ones is always preceded by a decrease in vigor of the most nutritious and best-liked grasses. These are nearly always the climax species. Decreased vigor may result from overgrazing or from drought.

If this sign of range deterioration is observed and stocking rate is decreased, or grazing deferred, or the pasture completely rested, the range will usually recover and often improve.

Vigor of the vegetation, composition, and density are the most important indicators among plants as to the condition of the range. Vigor is commonly shown by the size of bunches or clumps and especially by the number of stems, absence or presence of dead centers, and partial or complete death of tufts or bunches.

An excellent test of vigor under conditions favorable for development is that of prompt renewal of growth in spring, after grazing, or after transplanting. The last permits exact measurements of heights, production of foliage, and the rate of development and amount of new roots.

LIGHT REFLECTION FROM STUBBLE MULCH. By T. M. McCalla. Journal American Society of Agronomy, Vol. 39, No. 8. August 1947.

The purpose of this study was to compare the amount of light reflected by uncovered soil surface with that reflected by different types and amounts of residues during decomposition while left on the surface of the soil for protection against wind and water erosion.

It was found that dark straw reflected less light than bright straw, but more than unmulched, plowed land. Light reflection was also influenced by the density of the mulch cover.

A close relationship between light reflection and soil temperatures was found to exist. The mulched with bright straw reflected the most light and warmed the most. The soil with the dark straw mulch was intermediate in its effect on light-reflection and soil temperature.

Marshall silty clay covered with bright straw reflected twice as much light as plowed land. Four tons of straw per acre gave maximum reflection of light.

As decomposition progressed there was less ground coverage and the residues became darker in color with reduced light reflection. Under many conditions of stubble mulching in the field, light reflection was not much greater on mulched areas than on plowed land. Shading of the land with growing corn reduced light reflection about 50 percent.

SEND TODAY for this catalog. It lists and describes the movies, booklets, slide films, wall posters, charts, etc., comprising Case "Visual Education Materials." It also tells how to secure supplies of printed items and to schedule the loan of films. Address Educational Division, J. I. Case Co., Racine, Wis.

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● Here are powerful pieces of ammunition for your campaign to push soil conservation beyond the realm of academic acceptance into the living world of everyday farming. They portray conservation with all the dynamic suggestion of actual procedure and tangible results. Because they inspire and instruct farmers in advanced practices with their own farm tractors and implements, they implant the idea of conservation as a way of normal farming.

Titles of a few educational booklets shown above will suggest the scope of Case materials available. Most of them have parallel films of similar title and subject matter. Some are supplemented by wall posters or charts suitable for exhibits at meetings, and for lecture-study use. In all, the purpose is to be simple, clear, vivid.

Case movies on soil conservation and related practices embody tested methods in detail. They are all in the 16 mm. width, in full color and sound. With their companion booklets for detailed study and permanent reference, they provide both initial stimulus and a follow-through. You are invited to use them.

CASE

Conservation Program Under Way in Canada

RALPH H. MUSSER

THE ONTARIO branches of the Agricultural Institute of Canada recently convened at the Ontario Agricultural College to discuss soils, economics, foods, horticulture, and other subjects. In addition, scientists also discussed soil erosion, loss of fertility, the influence of people, wind and water, and the need for soil conservation to feed a rising population. Ralph H. Musser, President of the Society, was the guest speaker of the convention. This is his report of this most outstanding meeting.

NEARLY ALL of an entire two-day program of the Agricultural Institute of Canada, held recently at the Ontario Agricultural College, was devoted to soil conservation. Leading scientists, including many conservationists, discussed conservation right across the board—from erosion and loss of fertility to the relationship of people and land. But the meeting did not terminate with just discussions. Definite recommendations were made in the form of a formal resolution embodying the thinking of the entire group.

In his words of welcome, Dr. W. R. Reek, acting president of the Ontario Agricultural College, commended the study of soil conservation and suggested that technical agricultural men have a definite responsibility in contributing to the general soil conservation efforts. Mr. W. H. Waddell, chairman of the convention, reminded the assembly that all basic essentials are products of the soil and that arable land is limited. Many other speakers highlighted Canada's land use problems and the need for doing something about it.

It was my privilege to address the group on the soil conservation program in the United States. I traced the history of the movement in our Nation from both the standpoint of depletion and waste to our activities in soil conservation. As laymen and scientists, we must recognize that loss of productive land anywhere on the face of the globe affects the people and nations of every other part of the world. Every acre which goes out of production means that the pressure is increased on the remaining good acres. If this understanding is not reached, and something done about it, those people having insufficient productive land will be consigned to a future of poverty and hunger and the discord that invariably follows. This is the condition of which strife is born.

No one practice alone is enough. No incomplete set of practices is enough. Only "acre-by-acre treatment," planned right out on the land by the operator and the farm planner, and then properly applied and maintained, will provide for wise use and continued production of our crop, grazing and forest lands. Such a program is in compliance with nature's laws.

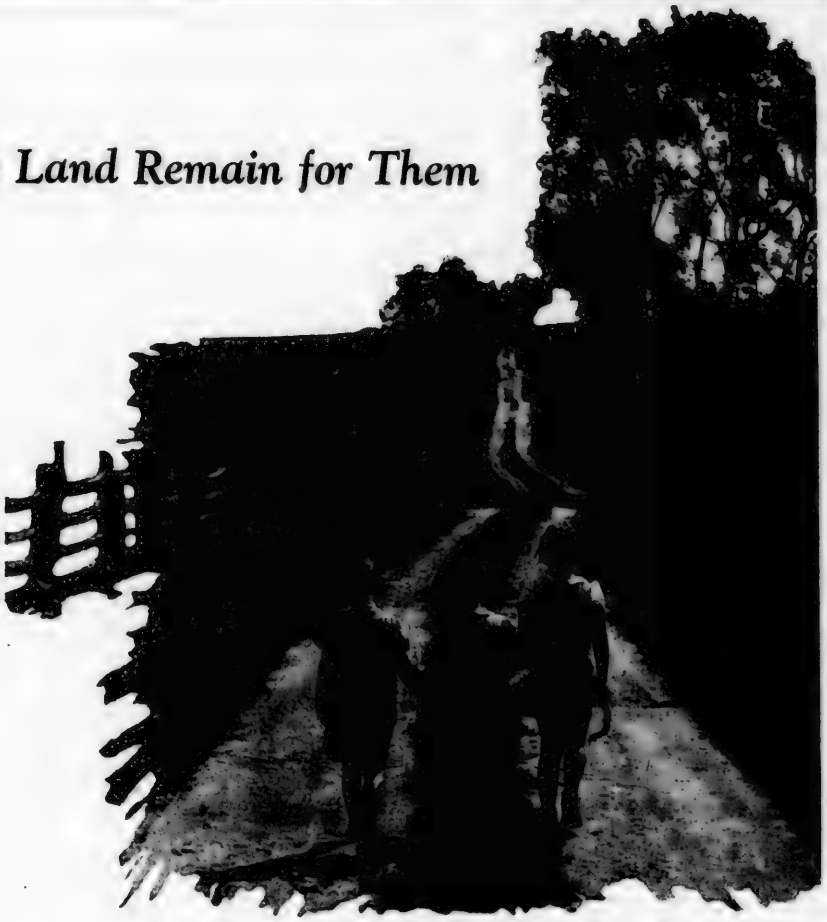
Since soil conservation benefits everyone regardless of his occupation, it is a matter of public concern. It is a job in which everyone has an interest and can play an important part.

The story of soil conservation districts, how they are organized and administered and what they are doing, was explained. Then I pointed out how we view soil conservation—as a profession which includes and uses many sciences to get the job done. This brought out a discussion of land use, soil conservation practices, the farm conservation plan and finally, how the farmer is doing the job on his land.

But as it is with all such discussions, the proof of the pudding is in the eating. And so it was at the meeting of the Agricultural Institute of Canada. The resolution which resulted from these discussions embodied six definite recommendations.

The first recommendation pointed out that the Agricultural Institute of Canada (A.I.C.)

Shall the Land Remain for Them



The answer to this question lies with those who till the soil — with farmers who plow and plant and reap.

But the task is not alone for them. In the final analysis, some part belongs to the other four-fifths of our population who also live from the land. The other four-fifths can seek to understand soil conservation, and strive to help build public sentiment for the preservation of land and water resources. This implies correcting wasteful habits of the past.

The House of Deere counts itself a friend of soil conservation, and commends soil conservationists for the work they are doing.

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should strive to arouse public opinion as to the seriousness of the problem through the press, organized farmers' meetings and by other means. In their second point the A.I.C. suggested that the federal government pass or revise acts to permit assistance for cooperation with provincial governments and individuals. Tying in with this, they then recommended that the A.I.C. approach all provincial governments to pass enabling legislation to allow fullest cooperation with land owners and the federal government in soil conservation, settling of immigrants, land clearing, soil fertility maintenance and land use.

Their fourth point dealt with the professional personnel problem involved in a soil conservation program. They brought out that the A.I.C. should impress upon the federal and provincial governments that there is a great scarcity of trained men capable to give guidance to farmers and governments in all such problems and that the many vacant positions in government service in related fields can be filled only by encouraging present students to specialize in the necessary subjects by higher salary inducements.

Fifth, the A.I.C. stands ready to support and assist in organizing farmers' groups and different departments in the provincial and federal government. They strongly recommended that individual members in each branch of government make it their business to become intimately acquainted with the conservation problems in their respective areas. Then in their final point, the A.I.C. recommended that all provincial governments take a serious view of the soil conservation program and proceed as rapidly as possible to see that a qualified soil conservation technician be assigned to each county or crop district.

Our neighbor to the north has started to initiate a comprehensive program of soil and water conservation. They are examining our records — our accomplishments — with a view, I think, of selecting the best for integration into their own efforts. I believe, also, they look at conservation much the same as we do—as a science. I know that the Society stands ready to assist, to counsel, and to learn with them, because we have an interest and an obligation in the soil and water conservation program in America. We can well join hands in an effort of such great importance to mankind in conserving our soil and water, using them to the fullest without waste, and sustaining productivity. Here, too the Soil Conservation Society of America can play an important role in the advancement of the science.

BOOK REVIEWS

(*Continued from page* 214)

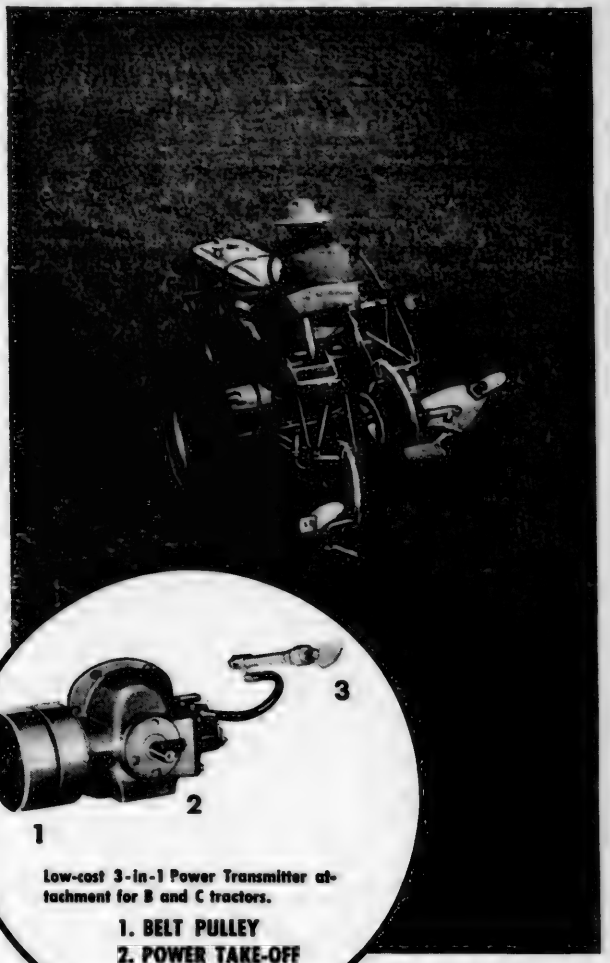
posting has already been accomplished on huge plantations in the Far East.

Once again, in this book, the controversial claim of superior, disease-free vegetation comes forward. Too literal-minded farm scientists are justified in their scoffing reaction to this claim only if they honestly feel that everything is already known about food and what it consists of. The U. S. Department of Agriculture Plant, Soil and Nutrition Laboratory, at Cornell University, has tested food raised with compost as the only soil amendment. They found no essential difference. However, one of the laboratory's leading scientists admits that food elements may be present for which there are no tests.

The only conclusion about superior nutrition from compost-raised foods is that no conclusion is possible. Strict-construction scientists, those who demand carefully documented proof, will call it hogwash. Followers of organic farming will say that results speak louder than laboratory tests, and will continue to compost and, apparently, thrive from it.

One thing is certain: if the advocates of organic farming flourish and burst out with buoyant health or not, they are nonetheless doing the cause of soil conservation a good turn because any system which calls for huge doses of organic matter in the soil is a natural ally of conservation. Howard is aware of the soil erosion menace and points to strip crops, terraces, and cover crops as important measures, and he gives due honor to Dr. Bennett.—ABEL BANOV

GIVE YOUR LAND A LIFT



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Allis-Chalmers Tractor-Mounted Implements ride steadily and evenly at the depth you set. They lift automatically. For example, oil pressure in the hydraulic system instantly lifts or lowers either bottom of the two-way plow (pictured above) at the touch of a lever. The right and left hand bottoms are alternated in plowing back and forth across the field. All furrows are turned in one direction, leaving no dead furrow. In hilly land all furrows can be turned uphill on the contour, forming small terraces to catch and hold moisture.

This is how A-C hydraulic-lift implements can help you do a moisture saving, soil-building job. They give you special advantages both on irrigated and dryland farming.

The new Allis-Chalmers tractor-mounted field cultivator, moldboard plows and row-crop cultivators — all with hydraulic control — can give a welcome lift to your land the year around.

Low-cost 3-in-1 Power Transmitter attachment for B and C tractors.

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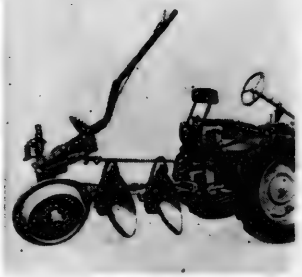
2. POWER TAKE-OFF
3. HYDRAULIC LIFT

The new A-C tractor-mounted Field Cultivator can be set deep for eradicating quack grass or renovating alfalfa... shallower for weeding, mulching or spring-toothing fallow.



A touch of the hydraulic control lever lifts the A-C tractor-mounted disc plow instantly. Saves a half-ton of hand lifting on every round, an especially valuable feature for terrace construction.

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BOOK REVIEWS

SOIL EROSION IN AUSTRALIA—An article in Walkabout, the Journal of the Australian Geographical Society, by R. G. Downes, February 1, 1947. Volume 13, Number 4, pp. 6-15.

IN "WALKABOUT," the Journal of the Australian Geographical Society, for February 1, 1947, there is a valuable and interesting article by R. G. Downes entitled "*Soil Erosion in Australia.*" The article is well illustrated with reproduced photographs of gullying and wind erosion. A brief quotation fro mpage 6 of the article contains the essence of the author's facts:

"There is no doubt that soil erosion has advanced to such a stage that it is seriously devaluing the national assets, in terms both of agricultural and pastoral land damaged and also of the lowered efficiency and increased maintenance costs of national works such as water storages, reticulation channels, roads and railways. The Soil Conservation Service of New South Wales considers that in the Eastern and Central Divisions of that State almost 50 percent of the land, or 60 million acres, has suffered some degree of erosion. In the lower north of South Australia near Jamestown an erosion survey has revealed that 7 percent of the arable land has been severely eroded, while a recent survey of an area between Dookie and Violet Town in Victoria has shown that with the exception of flat land almost the entire area has suffered some degree of erosion, and over quite large areas the damage has been great. In the mallee region of Victoria it is estimated that £60,000 is the average cost of clearing drift soil from the stock and domestic water supply channels, but in the year 1940 the cost was £110,000. Added to these costs are those of clearing the roads and railways in that area. These examples, all taken from agricultural areas, indicate the damage which can be caused by soil erosion, and when we consider the financial loss caused by lowered carrying capacity and lowered yields on these areas and on the thousands of square miles of outback pastoral country which is steadily deteriorating, it is obvious that the problem is really a menacing one."

There follows a discussion of types of erosion in various parts of Australia. The author notes that soil conservation services have been set up in the States of New South Wales, Victoria, South Australia, and Western Australia. The article closes with a brief discussion of contour cultivation, terracing, longer rotations in wheat growing areas, pasture improvement, and re-establishment of vegetative cover on non-arable lands.

—W. R. VAN DERSAL

THE SOIL AND HEALTH. By Sir Albert Howard. Devin-Adair, New York. 320 Pages. 1946. $4.00.

SIR ALBERT HOWARD doesn't like the fellows who labor in the hot-houses, laboratories, and fields of conventional experiment stations. He says they have "NPK" mentalities and are "laboratory hermits." On the other hand, they would rather have Sir Albert provide more conclusive proof of his claims for organic farming and a few less epithets.

Be that as it may, *The Soil and Health,* like *An Agricultural Testament,* and Faulkner's *Plowman's Folly,* and others of their revolutionary character, serve a good purpose. They tend to break the hide-bound channels of thought into which a maturing science like agriculture might come to set. Some of the sparks from Howard's flame are bound to ignite someone's imagination somewhere along the line and new lines of approach to agricultural problems in the western world are bound to result.

Probably the strongest objection to organic farming is the lack of plant materials for large scale composting. *The Soil and Health* takes care of that by showing how widespread com-

(*Continued on page* 212)

there's a **JOB** to be done

Badger Dragline starting to dig a farm pond in the Lake Champlain district of Vermont. The earth is cast first to one side and then to the other

These ponds are generally about 40 feet wide, from 7 to 9 feet deep and whatever length is needed to provide an ample supply of water

Most of these farm ponds depend upon rainfall plus seepage or springs for their water but this one is directly connected to a stream

Ponds to be Dug

Storing water in ponds is an important and increasingly popular conservation practice. These Vermont ponds are typical of thousands. In addition to furnishing water for stock, ponds have other uses including fire protection, small scale irrigation and recreation. Large ponds can best be constructed with tractors, scrapers and bulldozers, but small ones can be dug efficiently and economically with this Badger Crawler Dragline with its 3/8-yard bucket. When not digging ponds, this Badger is kept busy digging or cleaning drainage ditches.

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From the President

SOIL CONSERVATION is coming to be recognized as a science in its own right. This is well known and was clearly pointed out by the editor in the last issue of the JOURNAL. How can this new science make the greatest contribution to society? What is its place in a National program of soil and water conservation? Naturally the good that comes from it will be measured in direct proportion to its application toward solving the problems that face society. Clear thinking on these questions is imperative at this time, else the science will cease to be purposeful and remain only an accumulation of systematized knowledge.

Soil Conservation may be defined as the art and science of using land, within the limits of sound economy, according to its capabilities and needs so *that the land may be kept permanently productive.* Write your own definition if you choose but this one seems to cover the idea. Consider this definition in connection with the known damage to land in the three states of Iowa, Illinois, and Missouri as a result of erosion and floods during the month of June of this year. That flood cost the public nearly a billion dollars in soil and crop loss alone in these three states of the Mississippi watershed. From unprotected fields and overgazed pastures on this three-state area, 491,000,000 tons of topsoil were washed away and lost irretrievably to future production. In addition to this soil loss from sheet erosion on the upland, 40,000 acres of crop and pasture land were destroyed for further crop or pasture use by gully erosion and 15,000 acres adjacent to the streams were wiped out as a result of streambank erosion. The estimated cost to crop damage alone was $147,000,000 but this item falls outside the scope of keeping land permanently productive.

Right alongside the damaged fields were other fields under soil conservation farming that were practically undamaged. Measurements showed that the loss of soil was 20 times greater on the untreated fields than on the fields under scientific soil conservation management.

Here is a situation typical of a large part of the Mississippi watershed and it is familiar to us all. Where can the science of soil conservation best fit into the picture in order to make the greatest contribution to its solution?

The soil conservationist, as a scientist, does not guess. He works with facts. He determines what the land's capability is by studying land scientifically—a soil conservation survey. He knows what the land needs by reinforcing these studies with scientifically conducted experiments that prove what can be done and what results can be expected. He thus brings to bear a body of specialized knowledge on the problems of land use and land preservation *wherever these problems exist.* How he applies this knowledge to a particular situation is a matter of professional judgment on his part.

The three states of Missouri, Iowa and Illinois are only a part of the Mississippi watershed, with its various interlacing problems of upland, bottomland, and numerous tributaries. The Mississippi is only one watershed. The efforts of the soil conservationist cannot be confined within artificial boundaries if society is to get the maximum benefit. They must surmount all arbitrary lines and reach out to the natural elements which make up the very roots of the problem. To obtain maximum benefits for our country as a whole, the science of soil conservation must be applied through a broad program. It must include every phase of the science; for example, engineering, forestry, wildlife, range management, and reach every segment of every watershed. Only through this logical approach can the science of soil conservation serve society in the capacity that it is destined to serve.

H. H. Bennett

SEVENTEEN THOUSAND DOLLARS from 50 acres of single cross hybrid seed corn! That was one of the accomplishments last year of Champion Farmer John J. Gannon and his father, William P. Gannon, on their 785-acre farm near Valeria, Iowa. Hog sales totalled over 400 head. In a recent month, 16 purebred Guernsey cows, three of them dry, returned $504.78 over feed costs. Seventy head of purebred Aberdeen-Angus cows, and their calves, provide a profitable outlet for roughage. So does a flock of sheep. The Gannons bale 7000 bales of hay annually. Careful pasture management, manure and commercial fertilizers, and a soil conservation program keep the farm highly productive. For economy and efficiency in operating their farm equipment, Champion Farmer Gannon has found it pays to depend on Firestone tires. When he and his father buy new tractors, they specify Firestone Champion Ground Grips. In the photograph, Sheila Ann Gannon with her grandfather, William P. Gannon, and her father, Champion Farmer John J. Gannon.

For more information about Champion Farmer John J. Gannon, write to The Firestone Tire & Rubber Company, Akron, O.

Champion Farmers Specify Firestone CHAMPION GROUND GRIPS

TO GET extra pulling power . . . longer tire life . . . and smoother riding, Champion Farmer John J. Gannon and his father specified Firestone Champion Ground Grips for their new tractor.

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Notes and Communications

Vocational Agriculture Students Hold Grass Management Contest

Grassland is one of our most neglected natural resources. The reason for it is that we do not know grasses well. Grass is the main crop in the Hill Country around Kerrville, Texas, and cattle and sheep harvest this crop each year. A number of Future Farmers chapters in the Hill Country Soil Conservation District have already begun to learn about grasses, according to Bill Oliver, teacher and supervisor, Department of Vocational Agriculture, Kerrville Public Schools, Kerrville, Texas.

On May 2 they held a grass management contest. A big part of the contest was to identify and learn 36 of the common grasses in the Hill Country. Range men on the staff of the Soil Conservation Service, assisting the Hill Country Soil Conservation District, prepared the 36 grasses for the class. The boys identified and classified them according to their value for grazing; whether annual or perennial; habit of growth, whether sod-forming or bunch grasses; season in which they made their greatest growth; time of year when they were most useful for grazing; how they reproduce, whether by seed, seed rootstocks or stolons; and how they are affected by heavy grazing.

This type of Junior training is not very common over the country, despite the fact that grass is the major food manufacturing source of the universe. The best place to start doing it is with children while they are in grade schools and high schools.

—B. W. Allred

Special Issue of Soil Science

The October issue of *Soil Science,* edited by Dr. Firman Bear at Rutgers University, will be a special issue devoted entirely to soil and water conservation and good land use. The issue will be dedicated to Dr. Hugh H. Bennett, Chief of the Soil Conservation Service. It will be made up of an article by Dr. Bennett stressing the history of the conservation movement and an article on the problems of each of the seven regions of the Soil Conservation Service.

Anyone wishing a copy of this special issue may get one from the publisher if he orders immediately. The price is 60c for paper-bound copies and $1.00 for cloth-bound. Send orders and remittances to: Mr. Robert S. Gill, Waverly Press, Inc., Mt. Royal and Guilford Avenues, Baltimore 2, Maryland.

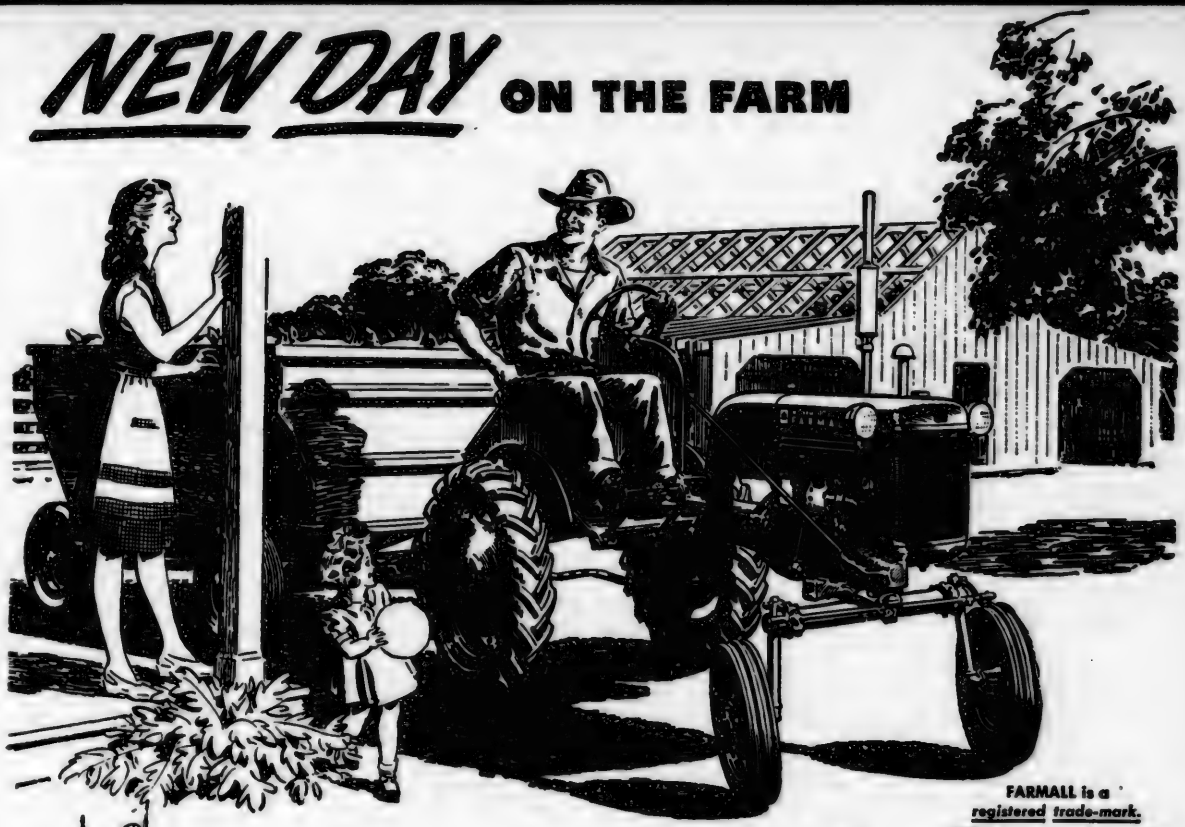
A Further Explanation of the Land-Capability Classification

The comments by E. N. Munns in the July Journal on the land-capability classification are constructive. They reveal a need for explaining a little further the concept of the classification scheme, how it has been developed, and how it is being used.

The present concepts and definitions, as expressed in the January issue, are the result of the ideas of a very large number of technicians. These men represent many specialized fields, such as soil conservation, soil science, agronomy, forestry, biology, ecology, engineering, farm and ranch management, and land economics. Moreover, the knowledge of experienced farmers has been blended with that of the scientists to arrive at a practical land classification that will meet the needs of a nation-wide program of soil and water conservation.

Since nation-wide definitions must be expressed in general terms, it is necessary in practice to make them specific for each local area. This Mr. Munns has done for examples of Classes VI and VII land that he knows best. His definitions are fully consistent with the concept that natural land properties may limit safe use or make necessary certain corrective practices.

NEW DAY ON THE FARM



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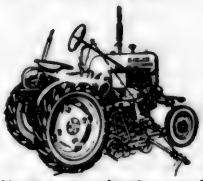

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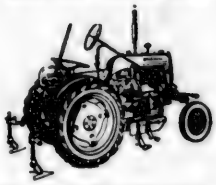

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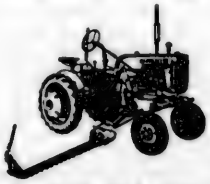

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The land-capability classes are sometimes too broad for detailed recommendations for specific treatments. It is necessary then to establish treatment units within a land-capability class. A treatment unit includes a specified range of soil properties, slopes, stages of erosion, and other land factors. The treatment unit may correspond, for example, to a range site as the term is frequently used. Then for a given site and forage type the recommendations for utilization vary according to the present range condition.

Subdivision of Class VIII may be necessary before specific treatments can be recommended. Mr. Munns lists two types, land for watershed protection purposes, and barren lands above timber line or in deserts. Another type of Class VIII land would be represented by coastal or inland marshes. The marshes are not suited for cultivation, forestry or grazing of domestic animals, but they may have substantial value as wildlife land. As for the scenic value of a desert or a sand dune, even these have their proponents.

Recommendations for cropland use of those Class II or Class III lands subject to wind erosion may well include the use of shelter-belts. See for example the published report on land conditions in Harmon County, Oklahoma (Physical Land Survey 40, U. S. Department of Agriculture, 1946).

The Soil Conservation Service is continually studying the land-capability classification, looking toward better general definitions of the major classes, and also toward more precise demarkation of significant land-treatment units. This effort will require the contributions of foresters, range specialists, biologists, agronomists, and all soil conservationists.

R. D. HOCKENSMITH

This statement was submitted by R. D. Hockensmith in response to an item that appeared in the July issue of the JOURNAL *by E. N. Munns.*

Steer Gains Shown on Burned, Mowed, and Untreated Ranges

Range steers do better during the summer grazing period from May until September on ranges freed of shinnery oak and sand sage on the Land Utilization Project west of Cheyenne, Oklahoma. Ranges were subdivided into 40-acre paddocks. One area is burned in the early spring, one is mowed in the early spring, and one has no treatment. Eight yearling steers graze the pastures approximately 120 days, although the number has varied with yearly changes in forage production. Steer gains for each pasture are shown in Table 1.

TABLE 1.—TOTAL STEER GAINS ON BURNED, MOWED, AND UNTREATED RANGES, CHEYENNE, OKLAHOMA, LAND UTILIZATION PROJECT, 1944-1947

Date	Burned Pasture	Mowed Pasture	Untreated Pasture
September 1944	1,920	2,320	2,080
September 1945	1,820	2,180	1,670
September 1946	1,960	2,000	1,600
August 1947	1,709	2,045	1,629

In every instance steers made 75 to 85 per cent of their summer gains by July 15. The good grasses are decreasing in the untreated pasture and oak and sand sage are increasing. The better plants are increasing in the other two but oak is more abundant in the burned pasture than in the mowed. The mowed pasture is the most uniformly grazed of the group.

—FRED L. WHITTINGTON and ARTHUR T. ELDER

Grass Keeps Range Soils Warmer

A good cover of grass is to a range like an overcoat to a man during sub-freezing temperatures, reports Allen Sheppard, Ranch Conservationist with the Soil Conservation Service, Big Spring, Texas. Observations made during sub-freezing weather the winter of 1947 on the A. & B. Fisher ranch, six miles south of Big Spring, revealed that a good cover of grass afforded protection to the soil surface. With an atmospheric temperature of 20 degrees, the soil surface temperature on closely grazed range was 27 degrees, whereas, just across the fence fifty feet away the soil surface under a good cover of sideoats grama registered 34 degrees, two degrees above freezing. Thus a good cover of grass affords much protection to grasses in winter so that they can stay green longer.

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